CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

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EIGHTEENTH CHEMICAL EXPOSITION ISSUE

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Chem & Met

NEXT MONTH

As usual, *Chem. & Met.* will report to its readers on what was new at the Chemical Exposition. This will supplement and complete our preview and review of new equipment which appears on pages 104-124 of this issue.

Of related interest, the *Chem. & Met.* Report will discuss cost of equipment and accessories. The report will be based primarily on work done by the Chemical Engineering Education Projects Committee of the American Institute of Chemical Engineers and recently presented by Professor Harding Bliss of Yale University. It will bring together a great deal of badly needed information on the economics of equipment selection and use.

The Pictured Flowsheet in December will show modern by-product coking and coal-tar utilization processes.

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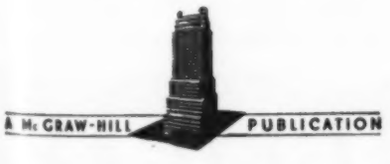
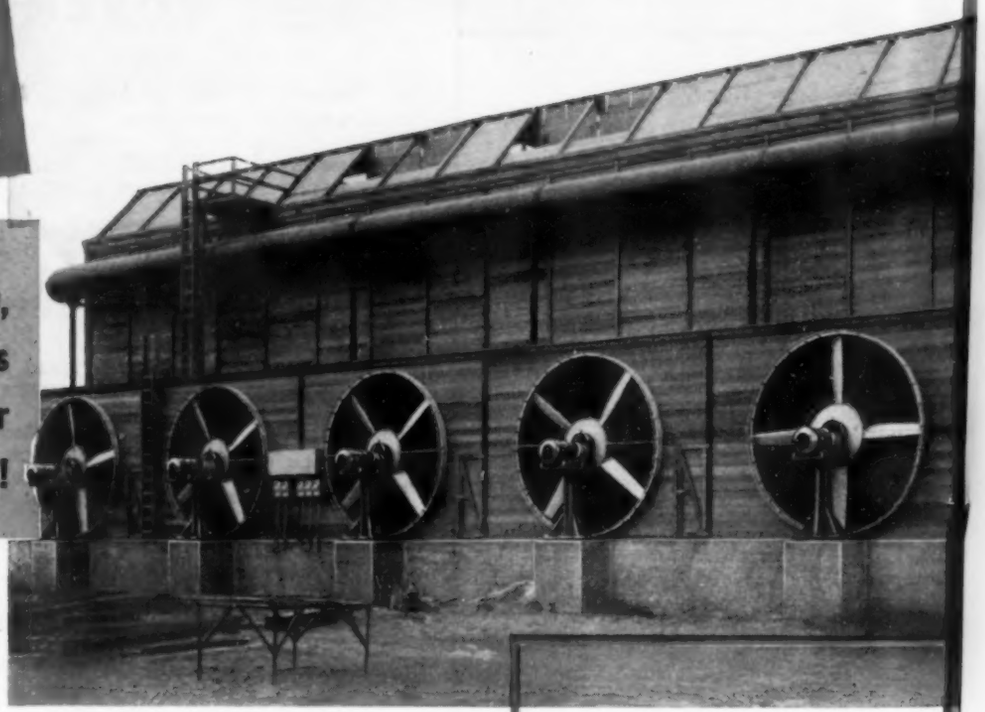


MAKES A CYCLONE

WITH ALLIS-CHALMERS MOTORS!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Panhandle Power & Light Company, Borger, Texas, Finds Allis-Chalmers Lo-Maintenance Motors the Answer to a Tough Operating Problem!



MAKING a man-made cyclone to cool 15,000 gallons of water per minute is a job in itself . . .

But when it has to be done outdoors in all kinds of Texas Panhandle weather — in heat . . . in rain and dust storms . . . then you've got a situation that calls for motors that are *better* than ordinary.

Recently when the Panhandle Power & Light Company put in a Foster Wheeler cooling tower at Borger, Texas, they knew they were up against a tough operating problem. Here's how they solved it —

They went to their own customers in the carbon black industry where motor conditions were notoriously severe . . . found *one* motor in general use. And that motor, they discovered, to be the Allis-Chalmers dust-proof, weather-proof Lo-Maintenance Motor!

That's why they selected these same motors . . . why today they can snap their fingers at all the hazards of outdoor motor service in the Texas Panhandle. And best of all — they know they'll continue to get low-cost, dependable service for many years to come.

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Cut Your Power Costs With Lo-Maintenance Motors!

For Allis-Chalmers Lo-Maintenance Motors are built with extra-value construction to give performance that's more than just their nameplate ratings. These motors are outstanding in having high carbon steel frame . . . indestructible rotor . . . distortionless stator . . . plus Allis-Chalmers famous no-stint policy in materials and workmanship!

Whether you have difficult or eas motor jobs, it will pay you to us Lo-Maintenance Motors. The traine engineer in the district office nea you will be glad to tell you ho you can cut power costs. Call hi today. Or write Allis-Chalmer Milwaukee.

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, *Editor*

NOVEMBER, 1941

INDUSTRY'S CALL TO ARMS

WHEN we are told that the United States is already committed to spend 60 billion dollars "to supply practically all the world (with the exception of the Axis Powers) with practically everything needed for both defense and offense," it becomes evident that such a tremendous program cannot be carried out with "business as usual." We are all in for serious sacrifices, in our personal lives as well as in our professional work. We have a job to do and despite its discouraging size and complexity, most of us would like to get it done quickly and effectively. Again quoting one who has reason to know the serious industrial implications of the defense program, "every day we delay is one day in which the free enterprise system of this country is impaired just that much more!"

What chemical engineers have achieved for our industries and our country during the past sixteen months is little short of miraculous. We have quickly built a great military explosives industry where scarcely a foundation existed two years ago. We are producing more aluminum and more magnesium to make more airplanes than any other country in the world. We have surprised even ourselves in providing substitues for many critical materials, such as silk, rubber and tin. We have provided the necessary man-power and machinery to equip more than 500 new chemical and munitions plants. Yet we have only started. A second chain of ordnance operations exceeding another half billion dollars is beginning to reach the drafting boards while the new chemical warfare and the lease-lend chemical programs are each mounting into the hundreds of millions of dollars. The farther and the faster we go and the deeper we have to dig into our resources, the more we have to stretch available supplies of man-power, materials and machinery.

The natural questions arise: Can we do this job? Isn't there a limit to our material resources as well as our human resourcefulness? If we have already developed painful shortages of certain chemicals like ammonia and chlorine, why should we continue to expand and inflate the demands for defense? Frankly, we believe that for those of us who are not easily discouraged, these questions should merely challenge us to still greater achievements. Compared with any other country in the world, we have more wealth to draw upon, more minerals and petroleum, more iron and steel, and more technically trained men and women. Our problem now is to make over our industrial economy to produce the things that are most needed and to do without the things that will not meet SPAB's test of essentiality as to defense, health or public safety.

This Eighteenth Chemical Exposition Number of *Chem. & Met.* is devoted to the single purpose of helping chemical engineers to answer the call to arms that is now sounding from war-conscious Washington. Weapons of attack as well as of defense will be found among the new developments in materials and chemical engineering equipment that are described in these pages and most of which will be displayed next month at Grand Central Palace.

The period of training is over. Our orders are now to march forward as the lines of battle become more clearly drawn. We have a job to do and the sooner it is done, the better. The longer we delay, the more we endanger all that we have at stake—our lives as free men, our hopes and ambitions for the only kind of a future true Americans want—our chance for the kind of life that money cannot buy. These are our world and they are worth fighting for.

★ ★ ★

Getting Out the Goods Under "ALL OUT" Conditions

ONE WHO HAS reason to know better than anyone else the extraordinary demands of the national defense program, has recently said: "From now on, nearly every aspect of our daily lives is going to be different. We shall work differently, play differently, live differently." And to add that this applies to the chemical engineer's job of designing, building and operating plants under present conditions, puts the case all to simply. You who are in chemical process industries face different as well as difficult problems.

So it is appropriate that the Eighteenth Chemical Exposition should differ markedly from its predecessors. It comes at a time when many of you are burdened with heavy responsibilities. Defense plants, already operating at full capacity, must be greatly expanded despite the increasing difficulties in getting the necessary construction materials and equipment. Non-defense plants, greatly stimulated by the unsatisfied demands for most goods, continue to operate to the fullest extent that essential raw materials will permit. But all this is due to change as we come to the realization that the defense effort can no longer be piled on top of our normal peacetime economy. From now on, military needs come first. The rest of us have got to get along with what's left. We've got to stretch to the very limit what we have or can get in the way of materials and machinery.

The more than 300 exhibitors at this year's Chemical Show can help you solve these problems. They are as anxious as you are to see that their products are used to maximum efficiency. They may not be able to supply you next week or next month with the new units you think you need, but they do appreciate your patronage and want to serve you. Sometimes, through their long and more specialized experience, they may have learned new operating techniques or minor alterations in original designs that will greatly increase your production. Sometimes there are alternative methods or modifications in processes that will avoid critical materials or release equipment badly needed for other operations.

The way to find out, of course, is to bring your problems with you to the Chemical Show and to discuss them with the men in the various exhibits who can help you most. Unless we miss our guess, there will be a higher proportion of technical men in the booths this year. Some manufacturers may feel handicapped by the fact that they are unable to display any late models of their equipment, but they can more than offset this disadvantage by providing adequate information and advice for their visitors. In extraordinary times like these a lot would be gained if each booth became a consulting engineering office on the availability of materials, designs, priorities, substitutes and alternative processes.

This whole matter of subcontracting—of sharing equitably in the defense load—is something that should have further attention at this year's Exposition. If you have an intermediate product that can be better made in another's plant, that possibility should be thoroughly explored.

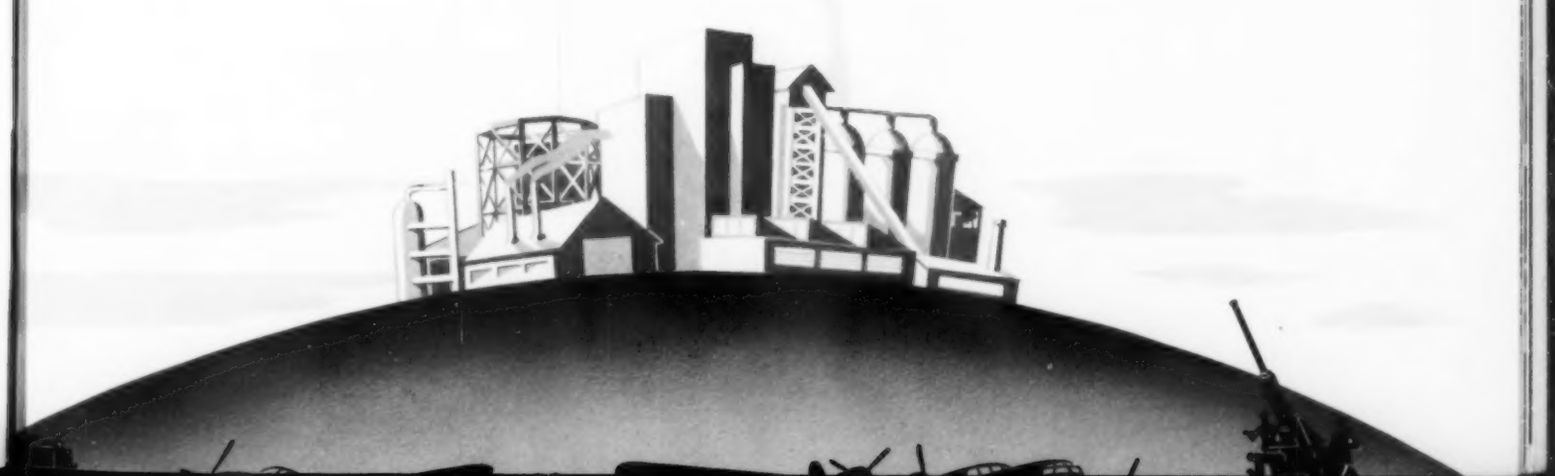
The ultimate requirement of the defense effort, according to Donald M. Nelson, executive director of Supply Priorities and Allocations Board, will be to turn all of industry into just one thing—"a gigantic, one-purpose factory for the production of armament and munitions." Chemical engineers know from experience that they always have much to gain through the hundreds of stimulating contacts that are so well provided by these biennial Chemical Expositions. But this year's show is going to be different. Something new has been added. It will not only answer the usual questions: "What's new?" but should provide practical help and advice for those in the chemical process industries whose job it is to "Get out the goods under 'all out' conditions!"

Chemical Engineering's ACHIEVEMENT

1941

CHALLENGING alike to both industry and profession, the past two years have laid heavy burdens on the shoulders of chemical engineers. Their country's demands for its defense called for the mobilization of vast resources of materials and machinery. Industrial manpower, particularly men trained in the engineering and economics of production, became the vital need of the nation as we moved into an "all out" program of preparedness for defense—or for offense should our cherished principles of democracy be further threatened by events abroad.

To meet fully these extraordinary demands, the chemical engineer has helped industry to multiply its production, to devise and develop new methods and materials, to transform the processes of peace-time economy to the ever mounting requirements of a people under arms. Many outstanding records and accomplishments have resulted from these recent efforts of American chemical engineers, but it seems especially



significant that this year the Committee of Award for Chemical Engineering Achievement should accord recognition to a great contribution to the national defense—the recovery from the sea of the magnesium metal so sorely needed for aircraft and munitions. That the 1941 award should go to a company long distinguished for its productive research is gratifying evidence that a resourceful chemical industry is one of our country's most valuable assets in time of need.

Almost all of the metals that have served mankind for centuries can trace their development to the work of mining and metallurgical engineers. Yet the production of magnesium, third most abundant engineering material in the earth's crust, is primarily a chemical engineering achievement. Both in this country and abroad, it has been developed from chemical raw materials, by chemical engineering processes, and was used, first, for chemical, and subsequently for structural purposes. Now that it has been successfully recovered, for the first time in history, from the world's richest source of mineral raw materials, American chemical engineers can take just pride in this further achievement of their profession.

To The Dow Chemical Company, for its "meritorious contribution to the advance of the industry and profession," largely made possible through the coordinated group efforts of its chemical engineers, *Chemical & Metallurgical Engineering* is happy to present the fifth in the series of biennial awards for chemical engineering achievements. The honor is richly deserved.

The first chemical engineering award was made in 1933 to Carbide & Carbon Chemicals Corporation for its signal achievement in developing a great synthetic chemical industry based on the hydrocarbons of petroleum and natural gas. The second award, in 1935, to the Organic Chemicals Department of E. I. du Pont de Nemours & Company, recognized the successful production in this country of two critical materials—synthetic rubber from acetylene, and synthetic camphor from American turpentine. In 1937 Monsanto Chemical Company was honored for its large-scale production of elemental phosphorus, a development that has laid the basis for a new heavy chemical industry. More recently, in 1939, the Committee of Award, selected for the first time a group outside of the strictly chemical industry, the Standard Oil Development Company, which had distinguished itself for the development of new aviation fuels and synthetic chemical products from petroleum.

Back of all these achievements, and much more important, is the creative spirit of progress and enterprise that best characterizes the chemical engineering profession. Its records of the past are but milestones to mark its continuing advance toward a future of greater service to American industry and to the American people.

The Committee of Award

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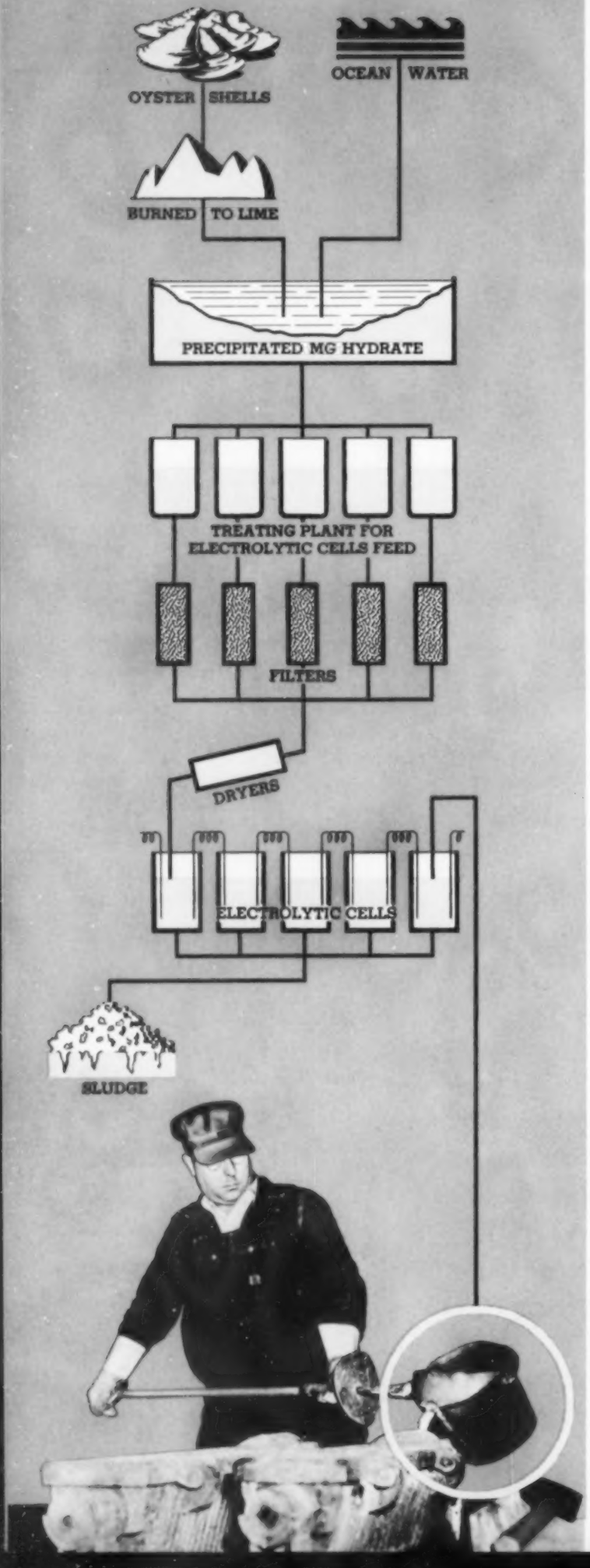


Magnesium f

ON TUESDAY, January 21, 1941, without fanfare or headlines, Dow's great new plant at Freeport, Texas, produced the first commercial ingot of any metal to be taken from sea water at any time in the history of the world! That this important event should occur almost without notice or knowledge of the outside world is in keeping with a traditional policy of The Dow Chemical Company—that production comes ahead of publicity. Furthermore, from the viewpoint of Dow's chemical engineers, they probably felt that this was not much of a story anyway. For years they had been mining Michigan brine for magnesium as well as bromine and chlorine and calcium and sodium salts. In 1934 they had successfully extracted bromine from raw ocean water at Kure Beach, N.C.—again for the first time in history. What happened in Texas was, therefore, just the next logical step toward recovering other values from Nature's richest storehouse. In short, these men had been brought up in the tradition of tackling big jobs and carrying them through to successful completion.

To understand this viewpoint and attitude toward what most of us would regard as one of the most outstanding chemical engineering achievements of our generation, it is necessary to go back a bit into the history of the Dow company and its unique position in the American chemical industry. From the time it was founded in 1890 by the late Dr. Herbert H. Dow, its impressive growth and development have been built on a tradition of technical independence and resourcefulness. Through the years Dr. Dow took pride in the fact that he had built a closely knit, self-contained, self-sufficient organization. He did not want to depend on outside sources for men or materials. He encouraged independence in thought and action and thereby developed a versatile, capable organization of strong technical men.

The coordinated group effort of this resourceful organization during the past eight or ten years has been responsible for many achievements other than the magnesium and bromine processes previously mentioned. Dow's chemical engineering completely modernized many organic syntheses, notably in the production of phenol and aniline from chlorobenzene. The development of the diphenyl-diphenyl oxide heat transfer medium known as Dowtherm brought industry a new tool for high-temperature processes. Dow's recovery of iodine from oil-well brines in California makes it no longer necessary for the United States to pay tribute to a foreign monopoly. The production of oil and gas has been materially increased through the Dowell process of

Clarence Hock, veteran Dow operator, pours first ingot of magnesium ever made from sea water (For detailed flowsheet, see CHEM. & MET. ENG., pp. 130-3, Nov. 1941)

from the sea....

SIDNEY D. KIRKPATRICK, *EDITOR, CHEMICAL & METALLURGICAL ENGINEERING*

acidizing oil wells. These are but a few recent highlights in a long record of unusual accomplishments.

But the chemical engineering achievement that fits most closely into the period of the present award is the recovery of metallic magnesium from raw ocean water. Construction of the plant at Freeport, Texas, was begun in March, 1940. Its first commercial production was just ten months later. Then in March, 1941, came orders to double its capacity and now, just as that expansion approaches completion, comes word from Washington that Dow's total production capacity, which will be 54,000,000 lb. of magnesium by the end of 1941, will have to be more than doubled next year. The total of Dow's production in its own plants and those built for the government and operated by Dow will probably exceed 125,000,000 lb. in 1942 if the present plans of OPM are consummated. This would mean a total of 14 times the 1940 production and more than 100 times the output of only seven years ago! The one rising and the other falling curve in the accompanying chart from the company's last annual report tell dramatically the whole story of the American magnesium industry. Annual production increased in 25 years from 87,500 lb. to 17,000,000 lb., while the price dropped from $5 per lb. in 1915 to 22½ cents per lb. in 1941!

Before describing the present operations of the new sea-water magnesium plant at Freeport, it is worthwhile to review briefly what was happening in Midland during that period in which production was mounting as sharply as prices were falling. It all started when the first World War in 1914 cut off the imports of magnesium chloride, then widely used in making cements of magnesium oxychloride. Dow had long experimented with the recovery of magnesium chloride from the brines already used by the company in making bromine and calcium chloride. It was therefore ready to meet this emergency and construction of a new plant was rushed to completion. Thus Dow became thoroughly established in the magnesium chloride business, and as the war continued and came closer home to us in this country, a great demand for magnesium metal developed for use in military pyrotechnics. By 1917 there were five American producers of this metal, but when the government's war requirements ceased, most of them promptly went out of business. Not so with Dow, however, who did not get into production until 1918 and persisted in the face of discouraging obstacles.

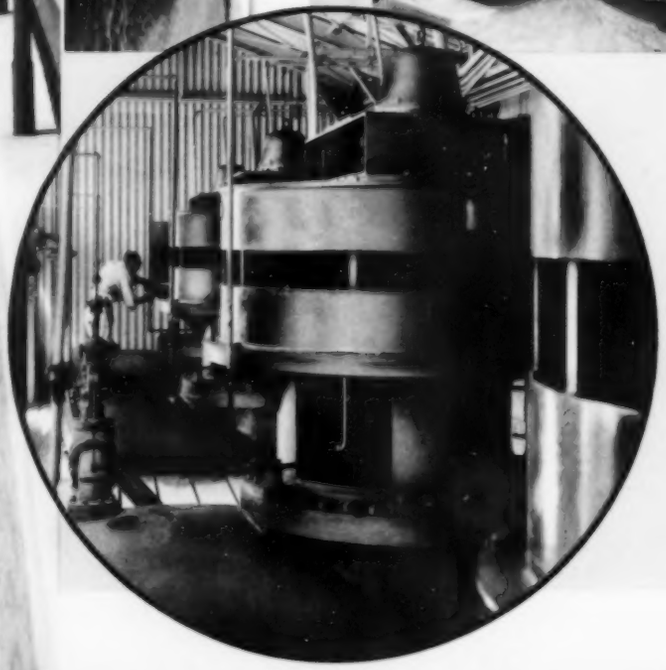
Again it was Dr. Herbert Dow's clear vision of what lay ahead and his keen personal interest in the new metal that kept the struggling industry alive in those early days. His chemists and engineers had developed a unique production process that peculiarly fitted into the scheme of things at Midland. Its raw material was, of course, the salt brines of that territory.

Unfortunately the problems of the magnesium business did not end with the development of the continuous process for electrolyzing anhydrous magnesium chloride to produce the purest grade of metal. It im-

On this 2000-acre peninsula in Freeport Harbor, Dow's chemical engineers rob King Neptune of his treasured metal

Oyster shells are dredged from the bottom of Galveston Bay, then barged to Freeport Harbor, washed and calcined to make the lime that precipitates the magnesium hydrate from the raw ocean water

From rotary washer, shown on the right, oyster shells are conveyed to storage piles or charged directly to the 300-ft. lime kiln. Meanwhile huge intake pumps, pictured in the circle below, bring in 300,000,000 gal. of ocean water each day. After screening, this flows through the 10-ft. flume, at left, to serve as raw material for bromine and magnesium operations



mediately became necessary to build up greater knowledge of the metallurgy of magnesium, to make more and more alloys and to determine their properties and possible applications. Gradually, as one after another of the difficulties of production and fabrication were met and mastered, it became apparent, at least to Dow's engineers and metallurgists, that magnesium was destined to become an important structural material. Its alloys are characterized by extreme lightness, being a full third lighter than aluminum, but combined with exceptional strength, toughness and durability.

Despite these unique properties and desirable characteristics, (see accompanying tables), the present widespread use of magnesium as a structural material developed only very slowly in this country. In fact it was not until about 1938 that our own Army Air Corps felt that magnesium alloys had sufficient corrosion resistance to warrant their use in airplanes. This was in striking contrast with developments abroad, particularly in Germany where magnesium alloy castings had been used in aircraft since the first World War. As a result of our slowness to adopt this new metal, the German industry developed much faster than ours.

In practically every year prior to 1939, magnesium production in this country considerably exceeded consumption. Nevertheless both curves were mounting and when the present emergency demanded rapid and tremendous expansion of both production and fabricating facilities, the industry was ready to do its part. Today 100 percent of Dow's production is going into defense, mostly for aircraft parts. When one considers that as much as 1,000 lb. of magnesium may enter into the manufacture of a single plane, and that we are scheduled to be turning out 4,000 planes a month in 1942, it is apparent that the aviation industry's demands for magnesium are reaching truly vast proportions. On top of these requirements, are the almost limitless quantities that may be needed for incendiary bombs and military pyrotechnics. Almost overnight magnesium has become a truly vital part of our national defense.

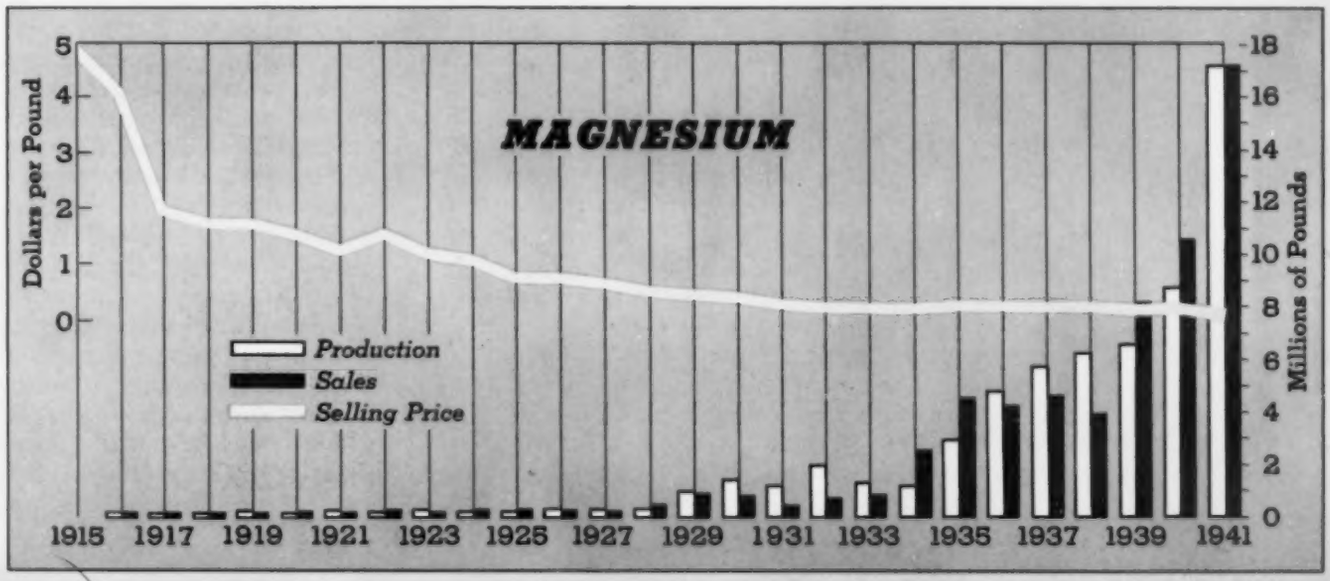
This is naturally most gratifying to those who have invested so much time, thought and money in its development. In the twenty years beginning in 1915, Dow spent upwards of $3,000,000 on magnesium re-

Relative Weights of Structural Metals

Material	Specific Gravity	Relative Weight	Weight Lb./cu.in.	Weight Lb./cu.ft.
Magnesium (alloys)	1.8	1.0	0.065	112
Aluminum (alloys)	2.8	1.6	0.101	175
Zinc	7.1	3.9	0.256	443
Cast Iron	7.2	4.0	0.260	450
Tin	7.3	4.1	0.264	456
Steel	7.9	4.4	0.285	493
Brass	8.5	4.7	0.307	531
Bronze	8.8	4.9	0.318	550
Copper	8.9	4.9	0.322	556
Lead	11.3	6.3	0.408	706

Comparative Physical Properties of Structural Castings

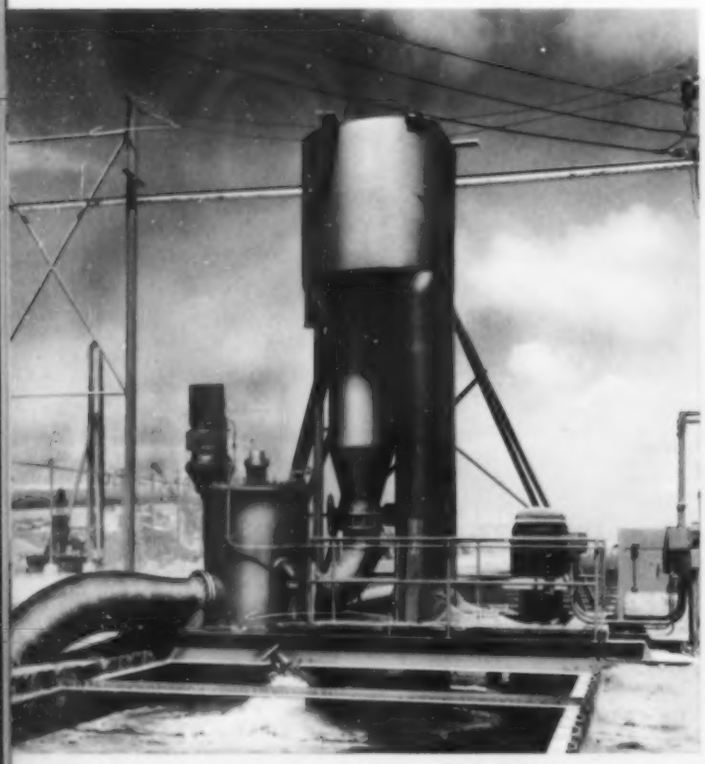
Material	Tensile Strength lb./sq.in.	Yield Strength lb./sq.in.	Fatigue Endurance Limit lb./sq.in.
Dowmetal H. Heat Treated	38,000	12,000	10,000
Dowmetal H. Heat Treated and aged	38,000	19,000	10,000
Aluminum-Copper Alloy No. 12 (SAE 30)	22,000	14,000	7,500
Aluminum-Copper Heat Treated Alloy (SAE 38)	36,000	22,000	6,000
Gray Cast Iron (Class 40, A.S.T.M. A48-35T)	40,000	——	20,000
Cast Steel (0.30% C Annealed)	76,000	42,000	33,000



search and development, yet no one in the organization has ever been heard to speak regretfully of these heavy expenditures, so confident were they that this was money well invested in a great metal of the future.

The Dow Chemical Company normally spends the equivalent of at least 20 percent of its net income for research and development—one of the highest ratios for any large industry in the United States. In the fiscal year ended May 31, 1941, its research and experimental expenses amounted to $2,262,697 as compared with a net income of $7,750,547 and net sales of $46,907,950. This is a research-to-profits percentage of 29.1 and research-to-sales of 4.8 percent. The latter is exactly double the ratio for all of chemical industry in 1940 as recently reported by the National Association of Manufacturers.

At the turn of the century, Dr. Herbert Dow himself was just about the entire chemical and engineering personnel of his company. A great inventive genius, he was also a pioneer practitioner of what has since become the profession of chemical engineering. As he built his great technical organization, he surrounded himself more and more with men of chemical engineering training and experience. His eldest son, who was to succeed his father to the presidency after the latter's death, October 15, 1930, had graduated from the University of Michigan in 1919 with a Bachelor of Science degree in chemical engineering. Later he was to receive honorary doctor's degrees from Michigan School of Mining and Technology (1939) and from his Alma Mater (1941). But Willard H. Dow served his apprenticeship in the factory rather than in the front office in order that he might learn the business from the ground up. Today chemical engineering at Dow's is recognized not as an adjunct or accessory of research or production, but as the underlying basis of the entire business. Chemical engineers have moved into positions of increasing responsibility in the Dow organizaton because they not only understand the chemistry of its manufacturing processes, but are competent to guide the economics as well as the technology of production and marketing.



This 10,000 g.p.m. vertical pump and head tank lift from the flume the sea water required for the magnesium chloride plant

It is from this background of sound research, efficient engineering and progressive business management that the Texas magnesium development got its start. The engineers and executives who were most responsible for building the sea-water bromine plant at Kure Beach, N.C. (see *Chem. & Met.* Aug. 1934, pp. 402-4 and Dec. 1939, pp. 771-4) had long been convinced that magnesium metal must ultimately be recovered from this same inexhaustible source. But they needed cheaper power and access to other chemical raw materials not immediately available along the Atlantic Coast.

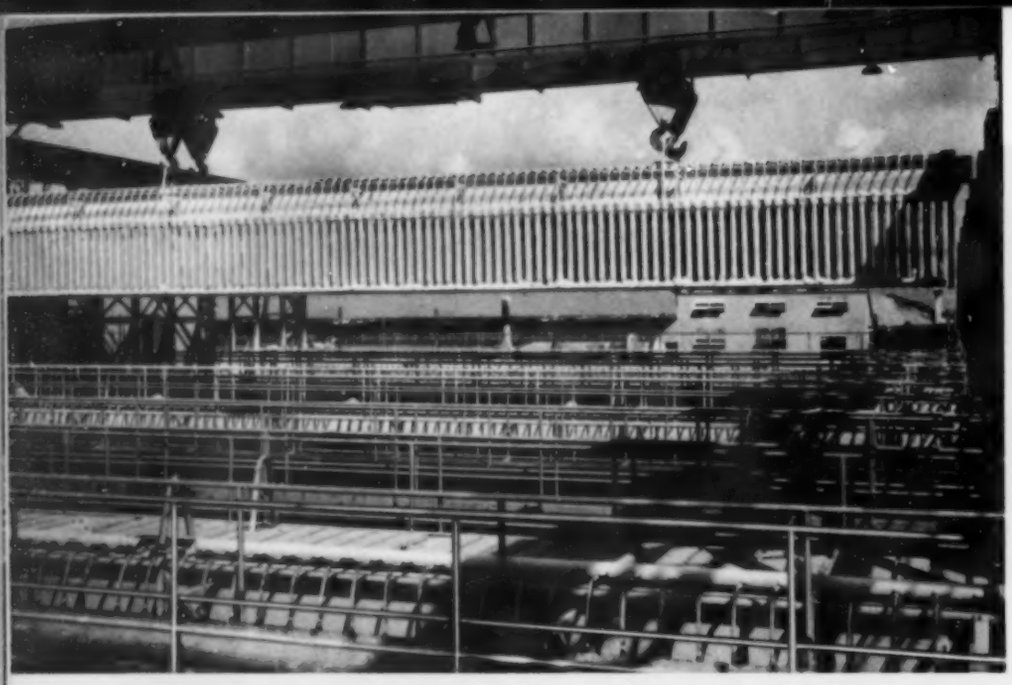
For more than a year various groups of Dow men visited and studied possible plant sites all along the Gulf Coast—from New Orleans around to the Mexican Border. They were most attracted by the trinity of basic inorganic chemical raw materials—salt, sulphur and lime, especially when combined with abundant natural gas and facilities for both rail and water transportation. Furthermore, to utilize sea water most efficiently, they had to have a site where the raw material could be pumped in at one side of the plant and discharged after processing in such a way that it would not dilute or otherwise affect the incoming ocean water.

They found an almost ideal topographical situation on a tongue-shaped neck of land in Freeport Harbor, adjoining the property formerly occupied by the Freeport Sulphur Co. The Harbor and deep sea channel had been created in 1929 by the United States Engineers Corps when the former channel of the Brazos River was dammed up with a concrete revetment about five miles from its mouth. This diverted the river into a new channel and it now flows directly into the Gulf some five miles south of its former mouth. Because of this unique situation, it was possible to select a plant site bordered on three sides by the ocean water of Freeport Harbor but so situated that the waste water could be diverted through a disposal canal that emptied into the Brazos River at least seven miles from the plant intake. Those who will recall the location of the bromine plant of the Ethyl Dow Chemical Co. on Cape Fear near Wilmington, N.C., will realize that Freeport offered an equally advantageous site from the viewpoint of its geography. In addition, it provided immediate access to basic chemical raw materials and abundant sources of natural gas and petroleum. Accordingly, it was selected not only for the new magnesium plant but also for an expansion of the bromine operations of the Ethyl Dow Chemical Co. Subsequently, a hydrocarbon unit was also added to produce such products as ethylene glycol and ethylene dichloride from natural gas, and the readily available caustic soda and chlorine.

Looking across the 200-ft. Dorr thickeners to the magnesium chloride plant in the background. Note interesting use of interlocking steel piling for side walls of thickeners. At left is the end of the rotary lime kiln and slaker

In the 150-ft. thickener in the foreground is made the milk-of-lime suspension which is pumped to the rectangular flocculator in the center of the picture. Here it is mixed with the raw ocean water. Resulting floc of magnesium hydrate is concentrated for filtration in the four 200-ft. Dorr thickeners which operate in parallel. Oyster shell piles and lime kiln in the background at the right

Lime and sea water mix here in the flocculator. The lime enters at the side and flows across the horizontal launders to meet the sea water entering the near end of the tank. A slowly moving agitator extends the length of the flocculator



Filtration here on a scale rivalling metallurgical operations! The large Moore filter baskets are hoisted from the filter tanks by this 100-ton crane. Note the white cake of magnesium hydrate on the filter leaves. After neutralization, the magnesium chloride solution passes first to the direct-fired evaporators shown below. Impregnated wood scrubbing towers are under construction in the foreground

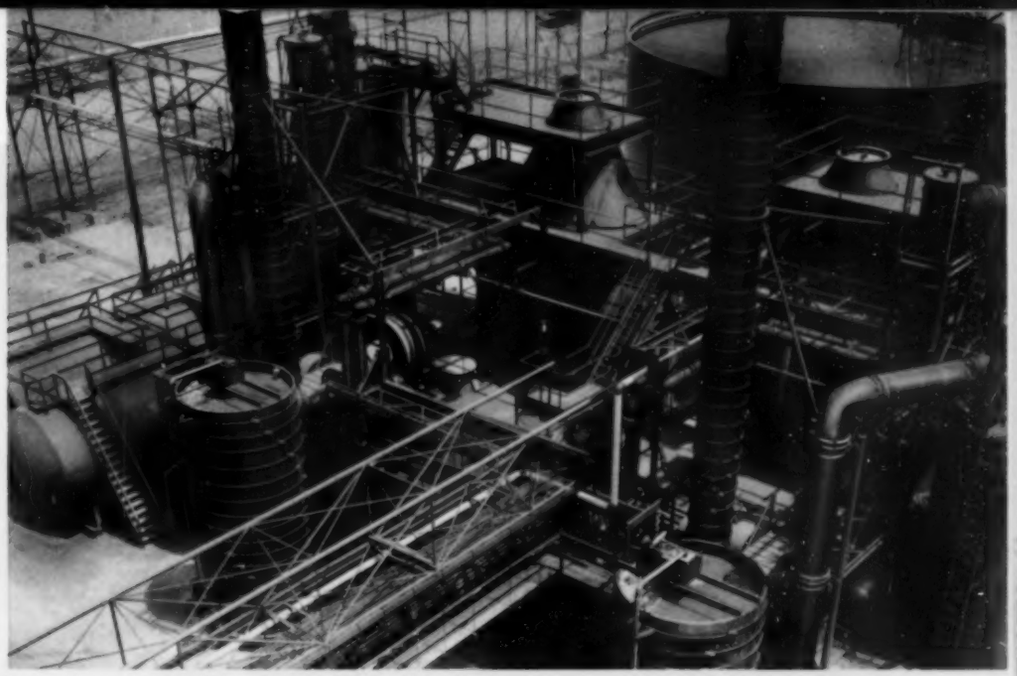
As the sea flows into Freeport Harbor, the heavier salt water lies beneath the fresh water on the surface. Hence the main plant intake for both the magnesium and bromine plants is almost 30 ft. beneath the surface so as to obtain the highest concentration of the desired ingredients. Here some 300,000,000 gal. per day of sea water is drawn into the plant by four Worthington centrifugal pumps, each with capacity of 71,000 g.p.m. Normally only three pumps are in operation with one standing by for relief service. Each pump is driven by a 500-hp. direct-connected induction motor.

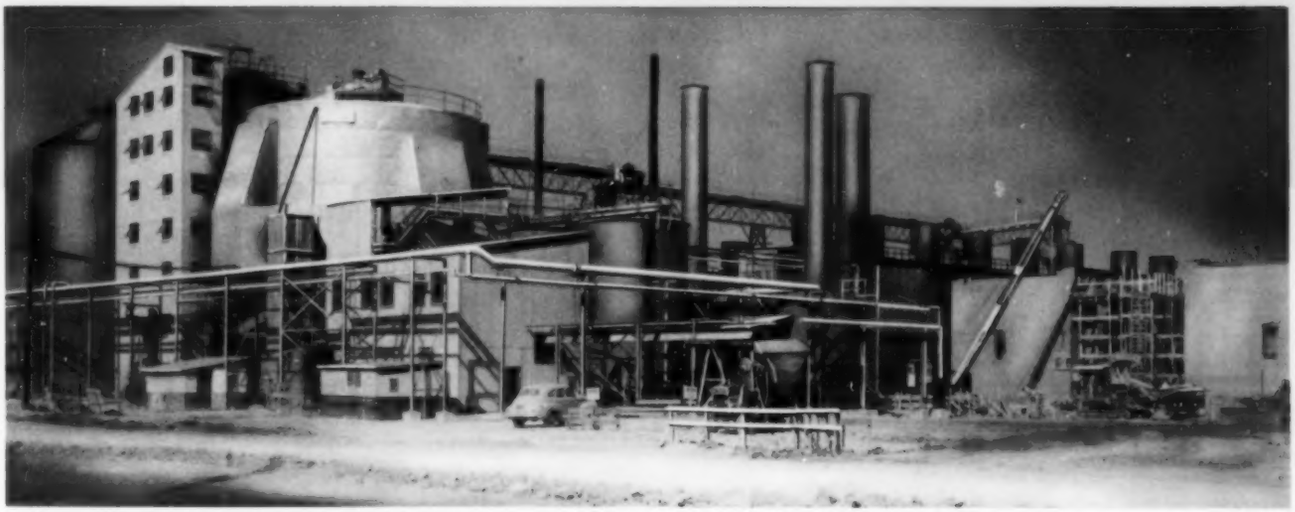
The sea water first passes through Link-Belt screens of the "roller-towel" type such as are widely used in screening municipal sewage. The coarser trash and refuse are held on its 1-in. openings. Then follows a group of 6-mesh rotary screens of a special type that Dow engineers had developed at the Kure Beach bromine plant. From these screens the clean sea water flows into a 10-ft. flume that traverses the plant site and carries the stream of raw material for both the magnesium and bromine operations. Because of the smaller concentration of bromine in the water, the Ethyl Dow plant requires many times the volume of water needed for the magnesium process. That part of the sea water used for magnesium production is lifted from the flume at two places by centrifugal pumps that will deliver 5,000 to 10,000 g.p.m. and at the same time give it the 10-ft. head required for flow to the first operation.

Now let us pick up the second important raw material—the oyster shells from which the lime is made. These are dredged from the bottom of Galveston Bay and brought by barges up the harbor to the plant. They are unloaded with clam-shell buckets and carried by a gantry to the shell washer. Here ocean water is used to remove sand and dirt. The washed shells go either to the huge storage piles or directly to the lime kiln. This 300-ft. natural gas-fired lime kiln is a Traylor unit, direct-connected with the lime slaker.

The milk-of-lime slurry from the slakers is pumped to one of the five thickeners in the Dorr unit. This is 150 ft. in diameter with 18-ft. side walls constructed of patented interlocking steel piling set in concrete, approximately nine ft. below the level of the ground. The four other Dorr thickeners, which are operated in parallel on the magnesium hydroxide slurry, are 200 ft. in diameter.

The lime slurry meets the sea water in the flocculator, which is of standard Dorr construction. It is a rectangular concrete tank, 28 ft. wide, 14 ft. deep and 80 ft. in length. The milk-of-lime is fed into the tank





Synthetic hydrochloric acid is made in this plant by burning natural gas in chlorine from the magnesium cells and adjoining electrolytic alkali unit. Rubber-lined HCl tanks are seen in the background. Below is shown the huge shell dryer with the magnesium chloride boiling tanks in the foreground and the overhead conveyors that carry the dry cell feed to the magnesium cell plant shown in the rear

through launders or weirs which are on the surface and spaced at about equal distances across the top of the tank. The sea water enters at one end and passes over baffles as it traverses to the other. The contents of the tank are slowly agitated with a reel- or barrel-type agitator extending the length of the flocculator.

Careful control of the liming operation requires precise adjustment of the pH of the mixture. A glass electrode unit, with calomel cell, relays its readings to a Leeds & Northrup Micromax recorder in the control house. Manual control is based on frequent laboratory titrations, also made in the control house.

The magnesium hydroxide floc suspended in sea water is then distributed to the four other Dorr thickeners. The clear overflow into the launders goes to the pump basin and ultimately to the waste water canal. Being slightly alkaline, it helps to neutralize the weakly acidic waste from the bromine plant. The heavy "milk-of-magnesia" underflow from the thickeners is picked up by Dorrco sludge pumps and carried to the storage or retention tanks ahead of the filters.

To filter the large volume of magnesium hydrate floc calls for an impressive example of unusual chemical engineering design and construction, especially in a chemical plant. Huge Moore filters of a type once widely used in Western metallurgical plants have been redesigned to accomplish this unit operation. Fully 90 ft. in length, each with approximately 100 canvas-covered leaves, the filtering units are lifted, lowered and shifted by means of a large overhead crane. First the filter unit is lowered into the rectangular concrete tank into which the magnesium slurry has been pumped. Suction is then applied until a cake an inch or 1½ in. in thickness has been built up on the leaves. Then the crane lifts the unit, carries it over and lowers it into an adjoining compartment where air is applied to loosen the cake. This drops off and a screw conveyor at the bottom of the tank carries it to the neutralizing unit.

Here in rubber-lined steel tanks, the hydrate meets the 10 percent HCl solution which converts it back into the magnesium chloride required for the subsequent electrolysis. The hydrochloric acid has been made elsewhere in the plant by burning natural gas in the byproduct chlorine from the magnesium cell house, supplemented with make-up chlorine from the electrolytic caustic soda cells in an adjoining building.

Now begin the magnesium chloride concentrating and drying operations that depart a long way from standard practice and equipment—at least as far as this writer's observations are concerned. The first step em-

ploys direct-fired evaporators. The dilute magnesium chloride solution is sprayed into the top of a cylindrical brick-lined furnace, nearly 20 ft. in diameter and 40 ft. in height. A spider distributor deflects most of the liquid down the side walls of the furnace in which natural gas is burned under pressure. The steam, along with the products of combustion, passes through another steel tower and finally into one of asphalt-impregnated wood, where baffles remove the entrained water and solution.

The concentrated magnesium chloride solution from the direct-fired evaporators is filtered through four Shriver plate-and-frame filter presses to remove solids that have crystallized out in the retention tanks. The filtrate then goes to the so-called shelf-dryers. In principle these resemble the burners widely used for roasting pyrites and other ores. Each is a structure 50 ft. in diameter and at least 50 ft. high with 12 shelves on to each of which the magnesium chloride is fed from the periphery while the solid material is raked to the center of the dryer and falls to the lowest shelf. Heat is supplied by two large gas burners and large circulating fans distribute the hot gases over the material on the shelves.

The semi-dried material from the shelves, from which perhaps two-thirds of the water of crystallization has been removed, receives its final drying to practically anhydrous condition in a gas-fired rotary dryer where it is mixed with previously dried material in flake form.

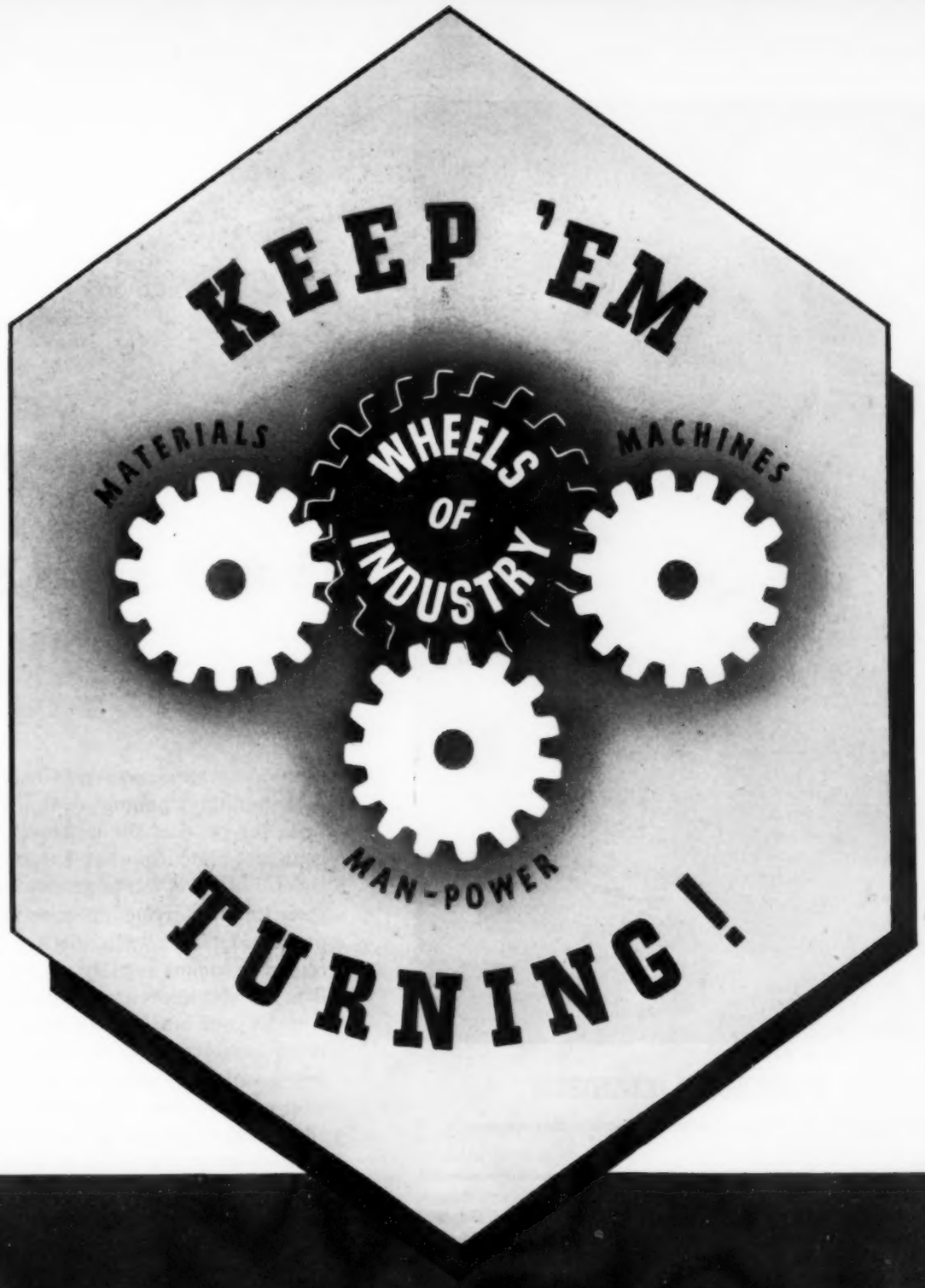
Details of the magnesium cell construction and operation at Freeport cannot be described at this time. From the paper by J. A. Gann presented before the American Institute of Chemical Engineers in 1930 (see Trans. Am. Inst. Chem. Eng., Vol. 24, p. 206 ff.) it is known in a general way that the cells are rectangular cast steel pots set in refractory brick furnaces. Each cell is about 6 ft. wide and 12 ft. long, shaped as a huge bathtub. The steel pot serves as the cathode in the electrolysis. Graphite electrodes enter the open top of the furnaces. The electrolyte is kept in molten condition (670-730 deg. C.) by gas-fired furnaces on the first floor level beneath the pots, or they can be heated by electric power alone. The normal operating voltage is six to nine volts. Power requirements for the Dow process are said to be 8 to 10 kw.-hr. per lb. of magnesium. The magnesium chloride charged to the cell bath is converted to magnesium metal in the ratio of about four tons of magnesium chloride to one ton of metal. Each cell produces about 1,000 lb. of metal per day.

The fused metal rising to the top of the cell bath is removed by hand ladles and cast into 18 lb. pigs which have an average purity of greater than 99.8 percent.

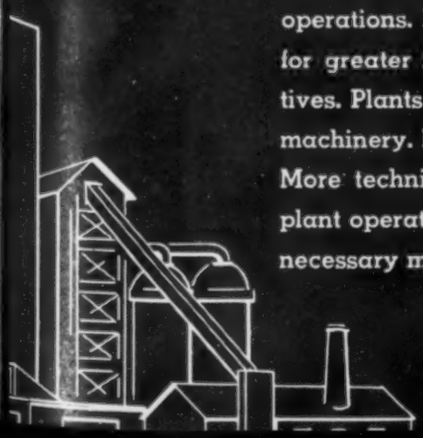
That the sea-water magnesium process and plant are the result of group effort by Dow engineers is evidenced in many ways. The only equipment other than that of Dow design is limited largely to the standard Dorr units, the hydrocarbon plant which was constructed by Stone & Webster, the lime kilns, the boilers, turbines and electric conversion equipment. Furthermore, the men in the Dow organization, who have had more than 20 years of direct experience with the development of the magnesium process, are the first to admit that there is no one engineer or small group possessing sufficient knowledge of the whole process to build a complete plant such as the one now operating in Texas. In other words, the magnesium sea-water process is not an achievement of any single individual. Rather it is the result of coordinated group effort that capitalizes fully on the broad knowledge and experience found in practically every department of the company. It well reflects the resourcefulness and spirit of independence that have long characterized The Dow Chemical Company.

An operator dips molten magnesium metal from one of the long bank of cells in the pot house. Note copper bus bar connections to the cell cathodes

Looking down on magnesium cell buildings showing vent stacks and the magnesium chloride conveyors



Introducing an impressive series of articles dedicated to one all-important purpose — to speed production of goods vitally needed for national defense and for essential industrial operations. Keeping the wheels of industry turning in the months ahead is going to call for greater ingenuity and resourcefulness by chemical engineers and production executives. Plants must be expanded despite difficulties in securing construction materials and machinery. Existing equipment must be made to work harder, longer and more efficiently. More technically-trained men are needed for management and supervision as well as plant operation. There's a big job to be done and chemical engineering must supply the necessary man-power, materials and machinery. These articles suggest ways and means.



Photograph: Chas. M. Hiller

WILLIAM S. KNUDSEN

Director General, Office of Production Management

Born in Denmark, immigrant worker in American shipyards and machine shops, foreman, superintendent, production manager, executive vice president and president since 1937 of General Motors Corporation, William S. Knudsen knows, better than any one else, what it takes to keep the wheels of industry turning out the goods his adopted nation needs for its defense

Let's Turn on the Steam

NOW AFTER sixteen months of planning and building plants, equipping and tooling them for the job, the national defense program is at last reaching what I call the "production stage." Any of you engineers who have had experience in starting up new plants know that production is slow in the beginning. Then it begins to mount rapidly as you get experience. But you also know how exceedingly dangerous it is to let your output drop or level off before you reach capacity. So I say that the next four or five months are going to be critical ones with most of our defense industries. We are going to need all the push we can possibly put behind the production program.

It has taken altogether too long for some of our industries to realize that this defense job is bigger and more important than anything we ever tackled before in this country. From now on the situation is going to get tougher for everybody. Materials are getting scarcer, machines busier, and men and executives spread thinner and thinner throughout our industries. And as this program gets bigger and bigger, money becomes less important as a gauge than production. The real test is the number of man-hours and machine-hours we can get out of our defense plants. Let's all concentrate on getting out the goods this country needs. So my plea to you production men in the chemical industries is this: "Let's turn on the steam during the next six months! Let's do the job and get it over and not drag it out for another ten years."

.....and Get Out the Goods

Harris and Ewing

DONALD M. NELSON

Executive Director, Supply Priorities and Allocations Board

Born in Missouri, educated as a chemical engineer and so serving Sears Roebuck & Co. for ten years after graduation, Donald M. Nelson, U. of Mo., '11, directed his energies toward merchandising in 1921. He became vice president in 1930 and executive vice president in 1939. Since early in 1940 he has devoted his great abilities to his country's major problems.

MODERN WAR is a war of materials and of productive systems. Today's army cannot be any better than its equipment—plus the ability of our industries and people to supply the necessary materials and machinery in adequate volume. And you men in the chemical industries know how fearfully complex are the requirements of a modern army. They call for such metals as aluminum and magnesium in incalculably greater quantities than any peacetime needs. They eat up such basic materials as steel and copper with an insatiable appetite. Ammonia and nitric acid, chlorine and sulphuric acid, synthetic rubber, alcohol, methanol and formaldehyde—are but a few of our chemical shortages. I sometimes tell my OPM colleagues that shortly about the only chemical raw material that won't be scarce will be "coal, air and water." And there may be some question about coal.

Too often, I find that business men are prone to blame their current difficulties on the priorities system rather than the increasing shortages of basic materials. There is a big difference. Priorities is merely one of the tools we use to adjust ourselves to these shortages. It is the most important immediate tool; but it does not, by itself, solve anything. We must do other things than issue priority ratings. We need every pound of material, every man and every machine we can possibly spare. We must find some means of adjusting our lives and our economy to this defense effort. This can be done and it will be done.

How to Ease Equipment Bottlenecks

EDITORIAL STAFF REPORT

Manufacturers without high priorities, as well as those with high ratings who still cannot get the equipment they need when they need it, are finding many ways of meeting demands for increased capacity, either with a minimum of new equipment, or without it. Revamping of the flowsheet may avoid duplicate units. A change from batch to continuous process, often with the same equipment slightly modified, may be the answer. Small local shops having no part in the defense picture can often build what is needed, quickly and at low cost. Many more expedients are possible.

THIS ARTICLE and those that follow it are dedicated to the proposition that American ingenuity recognizes no insuperable obstacles. If shortages force American industry to make bricks without straw, then make them without straw it will, and probably better bricks than by the old method. If chemical manufacturers are called upon to make an increasingly more prodigious contribution to the battle of production, make it they will in spite of time and materials, Hitler, hell and high water.

However, nobody can gainsay the fact that numerous vital construction materials are running short; that certain raw materials are becoming hard or even impossible to get; that available trained men are exceedingly scarce in some industries; and that deliveries on most kinds of equipment are slow, with some types even crowding the 1½- and 2-year marks. The native American ability to improvise and make the best of what is at hand will have to be given full sway if the job ahead is to be accomplished with our customary neatness and dispatch. Less scrambling for the scarce materials, and more attention to the ways of circumventing the need for them, or at least decreasing the quantity needed, are assuredly the watchwords of today.

There are just three things that are scarce now in the United States, so far as the re-arming effort is concerned: time, materials and, to a lesser extent, skilled man-power. A series of articles has been prepared which should shed at least a little light on ways to improve the condition of the chemical and process group with respect to these factors. The first is concerned with equipment for chemical engineering processes and the means which are at hand for extending the usefulness of what is available, or can at present be secured. Two articles discuss materials: construction materials for equipment, and raw materials for processes, with special emphasis on the choice of materials that are now most readily obtainable. Sometimes the substitution of one process for another will sidestep an equipment or material shortage and this subject, too, is treated. Another article considers present-day facilities for speedy employee training, and means for securing the skills necessary in supervisory capacities. Finally, even though they may in many cases not be quickly obtainable, new equipment designs signalize the approach of the Chemical Exposition, and so a lengthy concluding section is devoted to the design improvements of the last two years.

MAKING EQUIPMENT STRETCH

When the now famous York Plan chose as its motto "Do more with what you have," it struck a keynote that must rule today in many equipment matters. Chemical and process industries are to a large extent in the position of serving defense, either directly or indirectly, so that high priority ratings can often be secured, entitling the possessor to preferential treatment in materials and equipment deliveries. Still, the priorities system has been pushed beyond its limit in the case of some of the scarcer materials and possession of a high rating cannot guarantee adequacy of the supply. Allocations, which are gradually replacing the priorities system, may result in a fairer distribution, but even if ideal results are achieved, there will still be shortages. So great is the coming demand for military goods that even the most drastic cut in supplies of critical items allotted to civilian consumption cannot compensate, and it is inevitable that a substantial part of the new equipment needed cannot be secured in time to be of much use.

Fortunately, there are a great many things that can be done without waiting for extensive new capacity. American ingenuity, plus first class engineering, can uncover them. Principally, they fall into two groups: getting along without new equipment; and making a minimum of new equipment suffice. Still another possibility is the use of alternate construction materials of which ample supplies may be available. Some alternate materials may yield a poorer product, or they may more quickly be destroyed by corrosion. In these critical times, however, we cannot demand the last word in economy or efficiency. Whatever is "good enough" must be made to do.

The exact approach toward the problem of increasing output or providing new capacity for new types of production must, of course, depend upon circumstances. Still there are certain generally applicable paths that can be followed. With an existing process, doubtless, the first is a searching examination of the present set-up to locate weak spots and bottlenecks, both in equipment and in personnel. Possibly rearrangement of the equipment or re-routing of the flow will be all that is needed. Oftentimes many pieces of equipment in the flowsheet will be found to be

working considerably below capacity, while only one or two steps are holding up a large increase. Will stepping up the speed, pressure or temperature at these points bring them up to the pace of the rest of the process? Will a slight relaxation in the quality requirements accomplish the desired end? Will the substitution of a different type of machine or a continuous for a batch step eliminate a weak spot in the schedule?

Numerous examples can be cited where just such changes have been effective. For instance, an asbestos-shingle manufacturer doubled his grinding capacity with an overall decrease in power consumption through installation of a new grinding mill. A lime manufacturer increased his kiln capacity 20 percent by inserting a weighing feeder into the coal supply line. When a maker of shell forgings found that hand-operated hydraulic pumps for the pressure testing of the forgings were a bottleneck, he substituted a high-pressure proportioning pump—which would have been just as suitable for use in pressure vessel checking.

Continuous processing for bottleneck elimination is a method that is particularly fruitful. Generally, a continuous process requires less space than a batch method, since the quantity of material in process is much less and thus new building construction may be avoided. In many cases, an existing set-up can be converted from batch to continuous, either without additional new equipment or with only a relatively small amount. Progressive manufacturers of several types of equipment are thinking along these lines and are prepared to advise the best and simplest ways to effect the conversion, which can often be carried out by the user's own maintenance organization.

Even where the present equipment is not adaptable to the change, new continuous equipment is generally simpler and often less expensive than the equipment it replaces and can be secured with less delay than a duplicate of the old equipment. Furthermore, with the application of ingenuity it can generally be designed to get along satisfactorily either entirely without or with a minimum of scarce materials.

When the flowsheet reveals no bottlenecks, the problem may turn out to be one of improving the *use factor* of present equipment. Is production delayed by excessive down time for maintenance? by excessive rejects? by too high quality standards? Often in normal times, for competitive purposes, the aim in quality is set unnecessarily high and a silghtly lower grade today would be equally acceptable to users who might otherwise have to go without. Or the operating rate is held back to improve the yield or to lessen the wear and tear on equipment. Perhaps a slightly higher production cost *would* result from increasing the load. Let it; cost is much less of a factor in today's sellers' market.

REDUCING DOWN TIME

There are many ways available for reducing the down time due to maintenance. One is to make certain that lubrication of moving parts is not neglected, either through faulty equipment or personnel failure. Another is to eliminate points of recurring trouble by centering attention on improving their design. One equipment maker emphasizes the fallability of stuffing boxes and submerged agitator shaft bearings and concentrates on designs which prevent these from becoming maintenance breeders. Another points out the possibility of decreasing corrosion and hence maintenance through proper pH control. Still another suggests the maintenance reducing possibilities of properly conditioned process and boiler water.

When additional equipment proves to be the only possible solution to the problem, there are still many ways of securing it within a reasonable time. The most obvious way, of course, is through the usual channels of supply. When the chemical producer's high priority rating will guarantee prompt delivery, well and good. He should work with his supplier to speed up construction through simplifications and the elimination of materials that will be troublesome to get. He should redesign certain parts if necessary to avoid using the supplier's own bottleneck machinery and make use of his own maintenance organization if possible as a "subcontractor" to the supplier to ease the latter's load on those parts the chemical producer himself can handle.

A fruitful source of equipment that is not often tapped by most chemical manufacturers is the small local foundry or machine shop. When regular suppliers prove to be overloaded, these small shops can often ease the load, even though it may be necessary to teach them the intricacies of process equipment work. The chances are that these little fellows are looking for business and will jump at the chance to cooperate with the plant's own engineers.

One thing to remember is that ordinary cast iron is still one of the best construction materials for a tremendous quantity of chemical equipment, and that wood will often serve. These materials are readily handled by the small local shops. Another point that should not be overlooked is that the chemical plant's own junk pile may well yield the scrap necessary to supply the new material. In it may be found discarded equipment that can be made to fill in adequately with more or less rebuilding and rehabilitation. Used equipment dealers should not be forgotten in this connection. If they cannot meet exact requirements, there is always the excellent possibility that worn parts can be rebuilt or that the equipment can be modified to meet the specifications. Don't forget the welding torch and metal spray as tools for rebuilding. Many a hopeless appearing job will yield easily to their ministrations.

All of this goes back to our premise that many of today's equipment bottlenecks can be solved speedily through ingenuity and the will to improvise where necessary. America's re-arming will not be stopped by shortages nor will supply difficulties delay the chemical industry unduly.

Suggestions for this article have come from many sources. Particularly, acknowledgment for assistance should be made to H. L. Bullock, of Bullock, Smith and Associates, New York; D. G. Black of the Syntron Co., Pittsburgh; A. Brothman of the Hendrick Mfg. Co., Carbondale, Pa.; and G. W. Jarman, Jr., of the Separations Engineering Co., New York.

TEN WAYS TO HELP AN ALL-OUT PRODUCTION SPEED-UP

1. **Eliminate equipment weak spots and bottlenecks**
2. **Work bottleneck equipment to full capacity**
3. **Change from batch to continuous process steps**
4. **Design new equipment to be built from plentiful materials**
5. **Improve the "use-factor" of equipment**
6. **Relax quality standards slightly if harm will not result**
7. **Reduce down-time due to maintenance**
8. **Insure freedom from wear and erosion by good lubrication and good design**
9. **Simplify equipment designs to speed deliveries**
10. **Comb plant junk yard for re-usable materials, rebuildable equipment**

Substituting Construction Materials

EDITORIAL STAFF REPORT

To the chemical engineer who has become accustomed to depend to a great extent on the stainless steels and other high alloys for his materials of construction the present situation is extremely difficult. However, there are numerous means of overcoming the difficulties, some of which are presented here for his consideration. It is true that many of these measures would not have been adopted two or three years ago, but these are abnormal times and so unusual measures are justifiable.

IT IS TRUE that many of the metallic materials of construction for chemical engineering equipment the engineer has come to depend on are now difficult to obtain, but the situation is far from hopeless. There are numerous means that may be taken to prevent the situation from becoming disastrous. Many of the steps would not have been adopted two or three years ago, but these are abnormal times and so unusual measures are justifiable.

It is possible to extend the life of existing equipment by more attention being given to maintenance. The supply of special metals can be greatly stretched by the use of clad metals, linings, electroplated coatings and the like. The use of these reduced amounts of the metals may make priorities much easier to obtain. Highly alloyed material should be specified only in places where attack is great or where frequent replacements would be a hardship. Remember that the fewer the critical ingredients in an alloy, the easier will be the problem of obtaining the material. Sometimes a re-examination of the process will bring to light means of reducing corrosion although it may be at a sacrifice of efficiency. Substitution of a slightly more expensive chemical in some instances will reduce the rate of attack on the vessel.

Greater use of cathodic protection will lengthen the life of some pieces of equipment. Where possible, the specification of the product should be relaxed. Reconsideration of equipment design for purpose of elimination of opportunity for aeration of liquor whose corrosion is aggravated by presence of dissolved air is worthwhile. Impurities that cause corrosion may be removed. The use of non-metallic materials should not be overlooked for they often offer equal or greater resistance to corrosion. They have been vastly improved in recent years.

IMPROVE MAINTENANCE

In an emergency which makes new equipment extremely difficult to obtain and sufficient metal for making even emergency repairs very elusive, it behooves engineers to exhaust every means at their disposal to maintain the installed filter presses, kettles, centrifugals and pumps in working order.

The care and maintenance of all plant equipment should be placed in the hands of the most skilled mechanics, men who are anxious to know, and capable of knowing, all about hidden construction, and how to proceed with adjustments if and when they are required.

A well-systematized preventive inspection plan will pay big returns. If corrosion and abrasion are caught in their early stages proper steps can be taken to prevent further deterioration. Parts subjected to conditions which cause excessive wear can be built up to their original dimensions by spraying on additional metal, thus restoring them to their former usefulness. The process is simple and outside of the initial cost of the metal spraying equipment, the cost is low. Varying degrees of success have been experienced but in almost every case where the proper metal was correctly applied the results have been gratifying.

Where the equipment is showing indications of corrosion, it is sometimes possible to prevent further attack that might render the part unfit for service. Protection may be accomplished by spraying on a coating of a metal that will resist the corrosive action of the chemical being processed or handled. In other instances, protection may be obtained by covering the part under attack with a chlorinated rubber, synthetic resin or other suitable base paint.

CHANGE RAW MATERIALS

When it is necessary to have additional equipment for which high priorities are not readily obtainable, the engineer must use his ingenuity. It might be worthwhile to re-examine the process, for a slight change in raw materials or method sometimes reduces the corrosiveness to a degree which makes it practical to use plain iron and steel and thus avoid the necessity for the alloyed materials of construction.

The story has been told of the experience of a manufacturer of salad dressing who had been processing the salt, vinegar, oil and other ingredients in a jacketed kettle, who found that by adding the salt only a few minutes before completion of the process instead of at the start, there was little time for attack of the metal and the useful life of the kettle was thereby prolonged. This change in processing did not have any adverse effect on the flavor and other characteristics of the product.

In another plant it had been the custom to add the bleaching agent in concentrated form to the mass to be

bleached. This strong bleach attacked even special alloyed equipment, and so a change was made in the procedure. The bleaching agent was first put into solution and this weaker material then added to the mass to be treated without introducing a corrosion hazard.

The substitution of one raw material for another in a process may help. A more expensive material may be justifiable. In some plants making phenol-formaldehyde resins ammonia is used as a catalyst while in other plants hydrocholoric acid is used. The latter has caused considerable trouble for it is one of the most troublesome of all chemicals to handle.

Since the advent of stainless steels, pressures and temperatures have been greatly increased. But perhaps, without too great a sacrifice, it would be possible to readjust operating conditions so as to lessen the corrosive attack and thereby make it possible to employ other materials of construction. In some cases it may be necessary to accept lower operating efficiencies for the period of the emergency.

More careful control of impurities in a solution, when they are trouble makers, should be practiced.

Reconsideration of specifications for chemicals might lead to at least a partial solution to the problem of materials of construction for they are closely associated. There has been a very definite trend towards pure products. However, competition has tended to establish purity tolerances in some instances which are unwarranted by the benefits derived by the consumer. Where there is a diversity of market with varying impurity tolerances it is unnecessary that the whole production line be capable of furnishing material to the strictest specification.

INHIBITORS MAY HELP

Inhibitors are widely used to prevent attack by hydrochloric acid and other chemicals, but several authorities contend that even greater use could be made of these interesting agents. Cathodic protection too has saved many a tank or other piece of equipment from ruin. Consideration should be given to its use.

Development of synthetic resin and chlorinated rubber base protective coatings has stimulated progress in devising new means of protecting equipment employed in the chemical process industries. These new types plus the long established varieties offer the engineer protection against almost every form of corrosion.

Protective coatings are being widely adopted in the pulp and paper mills and in other industries. Both asphalt base and chlorinated rubber base paints are in use where there is alkaline corrosion such as on concrete, piping, tanks, and brick work in chemical recovery departments of the mills, and the latter is also said to be effective for combatting corrosion in and around the bleaching departments for both processing equipment and structural steel.

NON-METALLIC MATERIALS

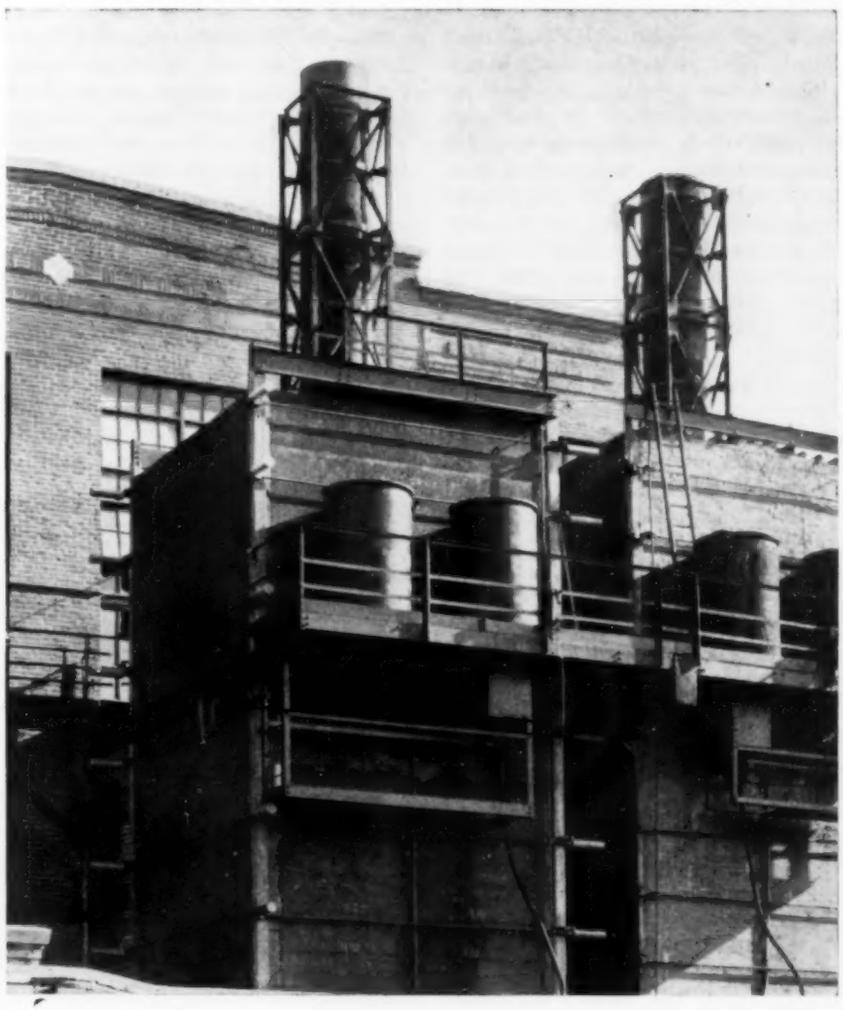
Non-metallic materials offer one of the simplest and best means of avoiding difficulties associated with obtaining metallic equipment. In this category are glass, glass-lined and fused silica, chemical stoneware, porcelain and cements, plastics, structural carbon and graphite, rubber and like products, and wood. Great strides have been made in improving the characteristics of these materials and in increasing the variety of available shapes, forms and sizes.

In recent years much greater accuracy is possible in making stoneware equipment. The manufacturer is able not only to maintain dimensions within a tolerance of ± 2 percent but by far the greater part of his products is kept within much closer limits. This uniformity makes possible the fabrication of extremely complicated shapes that were heretofore impracticable and also the grinding and polishing of the finished ware to a precision comparable with that obtainable with metals.

The most noteworthy achievement in the field has been the development of new ceramic bodies to meet the increasingly severe operating conditions that the chemical engineering progress has demanded. A new variety of ware has a thermal expansion much below that of the average grade of stoneware and consequently will withstand thermal abuse that would be impossible with the regular product.

Yet another type of ware is now

Entire structure of the electrostatic precipitator on the left including support beams for tube sheet is of carbon. Unit on right is ceramic



available with much higher thermal conductivity, and with an absorption comparable with that of the regular grade of stoneware. It can be glazed either the conventional brown color or white and a method has been developed for grinding it.

Some chemical manufacturers have modified the design of the proposed equipment so as to reduce the units to sizes that are practicable for fabrication from stoneware, and in other cases, where this cannot be done, the equipment is being built of iron and other base material and lined with chemical-ware tile laid in acidproof cement. It is significant that there is a similar trend in Europe.

GLASS AND GLASS-LININGS

It is only in recent years that stills, absorbers, filter blankets, columns, valves, pumps, industrial piping and fittings, heat exchangers, and a variety of other equipment made of glass have been available for plant service. Glass has become employed to a very considerable extent as a chemical engineering material. This is partly due to the improved technique of manufacture which makes possible shapes and weights of single pieces previously considered impossible. A new type of glass is Vicar 96 percent silica glass. It is made by methods which are as unique to the glass industry as is the glass composition itself. This ware can be used at temperatures of 800 to 1,000 deg. C. and has the outstanding corrosion resistance ordinarily associated with silica. Although it is still being made with pilot plant equipment and is therefore available only in rather limited quantities, it can be produced in sizes, shapes and intricacy of design which have hitherto been considered impractical of economical manufacture from glass.

Glass-lined steel equipment solves many problems involving severely corrosive acid conditions, and can frequently be used in preference to hard-to-procure alloys. It is available in a wide range of sizes in standard design, with a steady trend toward increasingly larger sizes up to at least 2,000 gal., and for greater working pressures. The quality has been further improved, and insured by means of more exacting methods of testing. Storage tanks are available in unit sizes up to 25,000 gal. and are in demand as an alternate to aluminum and certain alloys.

As another point of particular importance under present conditions, glass enameled steel equipment possesses a large degree of usage flexibility, since it combines reasonably good heat transfer with full resistance toward virtually all acid conditions. As a result, it can be used for a wide variety of chemical conditions, whether or not a process formula is changed or a totally different process substituted, this without being obliged to select equipment which is limited to one specific usage, and which might be rendered obsolete and irreplaceable.

The use of structural carbon and graphite has sharply increased for a wide variety of process industry applications. Bricks, blocks, tile, tubes, pipe and many special shapes of both products are available. Many of these articles are made impervious by special treatments, which change their properties to some extent, reducing the porosity to practically zero and eliminating permeability.

Rubber linings are being advantageously applied to many types of process, storage and conveying systems. For the most part synthetic rubbers are useful where the physical properties of rubber are desirable along with resistance to solvents, hydrocarbons and other chemicals that attack natural rubber. At present they find their widest application in the form of molded articles, hose, hose linings and fabric coatings. Several of these new materials are being used for tank linings.

PLASTIC EQUIPMENT

The British chemical industries have made considerable use of plastics for fabricating equipment (see "Resinoid Equipment in Wartime," *Chem. & Met.*, July 1941, pp. 90-92). In the United States the phenolic resinoids have been employed for their acid and alkali resistance but not to as great an extent. A newer development is the vinyl resin fiber filter cloth which is now being used in connection with dyestuffs, bleaches, pigments, pharmaceuticals, concentrated caustics, phosphoric acid and other chemicals that are often handled. Acrylic resins are used for pumps and certain other pieces of equipment. Their transparency and resistance are important characteristics.

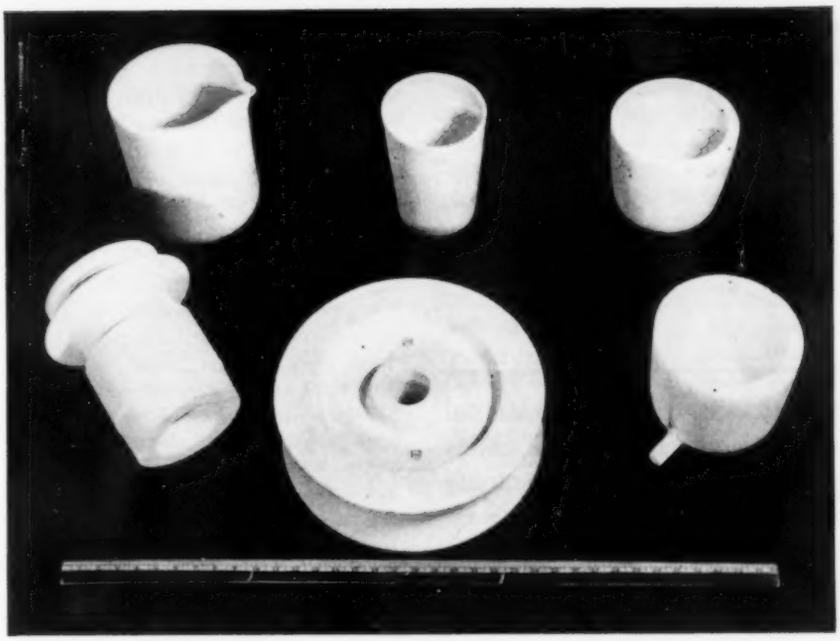
SILVER IS PLENTIFUL

Strange as it may appear, silver is the lowest cost metal that can now be purchased without priority restriction. A large supply has been accumulated in this country during the past decade. The price of silver equipment is not as costly, all factors considered, as many persons suppose. And as a result of the program of the American Silver Producers Research Project many data regarding its resistance to corrosion have been determined. A plant recently completed has as much as 20 tons of silver equipment.

The last decade has seen a considerable increase in production of platinum metals with a consequent reduction and stabilization of the market price. The current comparatively low price has made possible the acceptance of the clad material for many applications in the process industries. Most successful has been the development of heat exchange equipment. Heating and cooling coils, bayonet and candle heaters, and evaporators have been built with the tubes and tube sheets (see "Platinum-Clad Equipment," *Chem. & Met.*, March 1941, pp. 89-90).

If after exhausting every possible means of avoiding the use of the

One of the first all-welded stainless-clad steel tank cars



Some of the larger and more intricate pieces of process industry equipment that are now being made of 96 percent silica glass. Rule shown is 30 in.

metals on which there are restrictions on usage, the decision is reached to employ one of them, every effort should be made to hold down the amount required to a minimum. Electroplated coatings, linings, claddings and other means are worth consideration.

ELECTROPLATED COATINGS

Electroplated coatings on steel may prove valuable and economical, by permitting substitution of plated steel for metals needed for other purposes. Coating one metal with another gives surfaces with the properties of the coating metal by applying a relatively small proportion of that metal. While these very thin coatings do not offer protection under severe conditions for a long period there are many less severe services for which a coating will suffice. Chromium plating is especially worthwhile, as the chromic acid is produced from low grade ores that are not usable for making ferro alloys, chromium plating does not compete directly with the chromium alloys. It has been predicted (William Blum, "Plating Relieves Metal Shortages," *Chem & Met.*, Aug. 1941, pp. 78-79) that even gold and platinum metals may find more extensive use in industrial coatings.

Lining materials are not intended to be used under very severe corrosion conditions that would penetrate the lining in a relatively short period of service. A safe rule to follow is to limit the use of lining materials, except in special cases, to services where the average corrosion rate does not exceed 0.005 in. penetration per year. Extensive use has been made of thin sheets of corrosion-resistant metals and alloys as linings in steel and wooden tanks with satisfactory use. A notable case is the lining with nickel sheets of the cargo tanks of a large tanker employed for the transportation of liquid caustic soda and other commodities.

Most of the special metals and alloys are available in the form of claddings. Generally, the thickness of cladding is between 10 and 20 percent, though other thicknesses may be obtained. Obviously, these amounts of special metal offer greater protection than do linings and plated surfaces, and for most purposes are sufficient to withstand attack for long periods of time.

However, if none of the foregoing suggestions for avoiding the use of equipment made entirely from special alloys and metals are satisfactory, possibly the equipment can be so designed as to specify special materials only in places difficult to get at which could not readily be replaced without long shutdowns for repairs. Limit use of the alloys to sections of the piece of equipment where severe corrosion occurs. For example, in the case of soap kettles, the greatest corrosion occurs at the surface of the liquor where it comes into contact with air. A section a few feet wide could be made of special metal, the remainder of the vessel could be made of ordinary steel plate.

Remember in specifying alloys that the simpler the chemical composition and the fewer the critical metals, the easier will be the problem of getting priorities and deliveries of equipment.

Careful consideration should be given to any substitution of lower alloyed materials since, for example, it may be found in some instances that the useful life of equipment made from an alloy containing 10 percent of a critical constituent will be only one-quarter that of an alloy containing 20 percent of the same constituent, so that when the more frequent replacement is taken into account, there is not only no net saving in alloy, but in addition, unnecessary use is made of alloy production and fabrication facilities. For this reason, if, and when, such substitutions are made, an especially careful service record should be kept so that the actuality of the presumed saving can be established. It would seem likely that those charged with the administration of priorities would be impressed by such records in permitting the use of the most economical material.

Fortunately the number of ways in which important alloying elements are combined has increased within the past few years and furthermore there has been considerable accumulation of information as to proper applications of these materials. Consequently, since both the suppliers and users of corrosion resistant alloys are equally anxious that they be applied to best advantage, it would be desirable to give alloy producers even greater opportunity to apply the knowledge to the selection of materials of construction. This may in some instances require the giving out of information on processes formerly restricted to plant personnel.

In conclusion it may be stated that there are numerous means of solving the apparent difficult problem in materials of construction at the disposal of the chemical engineer. Some of the factors to be considered are the use of non-metallic materials, inhibitors, protective paints, cathodic protection, plated coatings, linings, clad metals, and highly-alloyed materials only in difficult spots. Control impurities to a greater extent, and lower efficiency of process. Reconsideration of specifications for chemical products might lead to at least a partial solution to the problem. Silver is the lowest cost metal that can now be purchased without priority restriction. It will probably be more generally used in the process industries.

Raw Materials For Defense

EDITORIAL STAFF REPORT

Shortages of chemicals and other materials essential for national defense and for producing civilian goods present a serious problem. How to apportion available supplies to fill all necessary needs and cause least dislocation to industry, concerns both Government and industry. Under government direction, producers and consumers have been rated according to relative importance as a basis for distribution and price ceilings are now in effect to check any inflationary movement. Industry can contribute much by conserving supplies, by substituting where possible and by avoiding waste.

BASED on interviews with Civilian Supply Section, Chemicals Branch, OPM: A year ago the chemical industry was confident it could supply both civilian and military needs except for a few commodities. Now the story is quite different. That dreaded word "shortage" has made its appearance in one place after another. Many chemical consumers are receiving a letter in response to their orders which reads like this: "We regret to inform you that due to heavy defense demands and previous commitments we are unable to accept your order of . . . We are therefore returning it herewith and suggest that you try another supplier." Puzzled and astonished, the would be purchaser then calls all the other suppliers he knows and finally writes a letter to his congressman.

A shortage is defined simply as a situation in which the supply is not large enough to satisfy all *needs*. However, many of the shortages today are due to insufficient supply to satisfy all *demands* or to satisfy all needs with the normal methods of distribution. Thus in many cases a careful rationing of the material either by the producers or by the Government will solve the problem without hardship to any consumer.

The question of why do we have the shortages often arises and deserves a fair answer. Of course, the general and immediate answer is that you can't create a brand new purchaser, National Defense, give him 60 billion dollars and permission to buy anything he wants, without disrupting all markets. That 60 billion dollars isn't money; it's materials and labor—almost as much material and labor as the whole country purchases in a year. It is bound to take huge slices of our civilian economy. But the more specific answers relating to the chemical industry are these: (1) There is little excess capacity in the chemical industry and (2) Defense demands, difficult to estimate, are always far greater than anyone suspects.

To be sure the productive capacity of the chemical industry of the United States is *elastic*. It can be increased within limits. Or it can be transferred from one product to another. But now *all* products of the chemical industry are needed because they are basic and essential. The chemical industry has practically no idle capacity and more often than not has no stocks because, by their nature, chemicals are not conducive to storage.

Defense requirements for chemicals are not significant because they are often indirect and incidental to the final product. For example, consider an airplane. No doubt a plane manufacturer can tell you how much aluminum is required for a thousand bombers. But how many plane manufacturers can tell you how much chlorine is required to build a bomber? Many of them might say none until you pointed out that chlorine is used to make magnesium for metal parts, synthetic rubber for tires and hoses, vinyl chloride for insulation, ethylene glycol for motor coolant, tetraethy' lead for high-octane gasoline, trichlorethylene for degreasing metal parts, resins for plastic parts, additives for the lubricating oil, chemicals for flares and smoke screens, explosives for shells, chlorinated waxes for waterproof tarpaulins, and carbon tetrachloride for fire extinguishers. These are only a few that come to mind immediately. Perhaps this example will indicate why it is impossible to say national defense will require X tons of chlorine. It indicates, too, why the big demand for chemicals comes not f· ·· the armed forces but from contractors and sub-contractors making parts for the military machine.

WHAT TO DO IN CASE OF SHORTAGE

Every manufacturer who uses a chemical raw material would do well to analyze his needs. He should answer to his own satisfaction these questions about each raw material:

How much was used last year?

How much this year? Estimates for next year?

How much is in stock? What can be done to conserve?

What other materials have been or could be used?

What would happen if the supply were cut off tomorrow? Were cut in half tomorrow?

Then he should make an analysis of his business to judge the essentiality of that use in comparison with other uses for the same material. How much of his produce goes to customers with priority ratings, to projects obviously defense but without ratings, to protect the public health and safety? Can the total of these be resolved into need for the raw materials in question?

Armed with these facts, the manufacturer is ready to contact his source of supply. At this point he should find out who makes these raw materials, who are the suppliers most likely to sell to him. Best procedure is to go first to the supplier who has been the most consistent source in the past. If possible, a personal interview should be arranged and all the facts set before the supplier. A regular schedule of shipments should be set up based on minimum needs and minimum stocks. In turn the buyer should inquire of his supplier as to his source of supply or raw material to find out what the chance is for shortage there. If such a conference is not satisfactory, other sources of supply should be approached.

When all else fails, the victim of shortage can and should state his case in Washington. He should contact the Priorities Division of Office of Production Management directly, either through OPM field representatives or by mail. Washington prefers to deal with overall industry problems rather than individual problems. The OPM commodity consultant will want to see and analyze all the data mentioned above. He will then (1) recommend a preference rating, (2) suggest an alternate method of solving the problem, or (3) state that he does not think a preference rating is justified. OPM will not attempt to act as a purchasing agent.

SUBSTITUTION

When all possibilities of conservation are exhausted, substitution is usually attempted. First question is whether there is any other way to do the job as well or better. If the answer is yes, it calls for an investigation of cost and availability of the new raw materials. If the answer is no, then the second question must be asked: How was it done ten years ago? In many cases a return to a former system means lower quality, higher cost, suspension of progress. But that is the price we have to pay for national defense. Substitution usually means sacrifice. The important thing to bear in mind when substituting is that the new material will be available and will continue to be available after all persons in the same predicament have made the substitution. The recent substitution of one metal for another and finally of plastics for metals made all of them short and taught manufacturers to be wary on this score.

An example of government attitude on substitution appears in order M-41, where preference was given to those uses of chlorinated solvents where non-flammability was an essential property. For other uses petroleum solvents may be substituted. Dry cleaners were classified both places because substitution may be made but not in the same equipment.

JUDGING ESSENTIALITY

The pattern of essentiality used by official Washington is beginning to make itself evident in the many orders that have been issued. Defense orders, of course, come first, and they have been defined as follows:

"Defense Order" means:

(1) Any contract or order for material or equipment to be delivered to, or for the account of:

(i) The Army or Navy of the United States, the United States Maritime Commission, the Panama Canal, the Coast and Geodetic Survey, the Coast Guard, the Civil Aeronautics Authority, the National Advisory Commission for Aeronautics, the Office of Scientific Research and Development;

(i) The government of any of the following countries: The United Kingdom, Canada, and other Dominions, Crown Colonies and Protectorates of the British Empire, Belgium, China, Greece, The Kingdom of the Netherlands, Norway, Poland, Russia, and Yugoslavia.

(2) Any contract or order placed by any agency of the United States Government for material or equipment to be delivered to, or for the account of, the government of any country listed above, or any other country, including those in the Western Hemisphere, pursuant to the Act of March 11, 1941, entitled "An Act to Promote the Defense of the United States," (Lend-Lease Act).

(3) Any other contract or order to which the Director of Priorities assigns a preference rating of A-10 or higher.

(4) Any contract or order for material or equipment required by the person placing the same to fulfill his contracts or orders on hand, provided such material or equipment is to be physically incorporated in material or equipment to be delivered under contracts or orders included under (1), (2) or (3) above.

Next in importance comes public health and safety. Third consideration is keeping the wheels of industry running smoothly (G.P.O. No. P-22 applies here). Fourth consideration is dislocation or unemployment of labor. Then the final classification involves uses for which substitutes are readily available and uses which may be postponed or eliminated without undue hardship to the majority of the people.

CONSERVATION

When the supply of any material appears to be insufficient, the first method of extending it is conservation. Many factories will be repaid for reconsidering formulas for chemical needs in light of the present situation. It may be that some economic consideration prompted the chemical engineer to be wasteful of a material to conserve man-power or otherwise reduce cost. Now when production is more important than price, such decisions may be reversed.

Many chemical companies are now sending their sales force and technical service people into customers plants not to sell more material, but to show them how to make the material they bought go farther. In the case of refrigerants, one manufacturer is spending considerable money in advertising to urge his customers service organizations to check every installation to insure against leakage. Some publicity has been given to the A B C's of dry cleaning, showing how to make solvent go farther.

COMMODITY REVIEWS

It is not possible to make any general statement about the availability of chemicals. A member of SPAB recently remarked in jest that the only materials that would not experience a shortage were lumber, air and water, and he wasn't positive about lumber. There may be more truth than jest in that statement before this war is over. At present, a general picture on chemicals may be drawn from a few specific examples.

Chlorine—One of the biggest problems from the standpoint of number of persons affected is chlorine. The rate of production, roughly 650,000 tons in 1940 has been increased by an estimated 75,000 tons. Still defense needs were so high that the paper industry had to curtail consumption by 18 percent of the scheduled use for 1941 and are now planning more serious curtailment. In 1940, about 25 percent of total production was consumed in pulp and paper processing. About 65 percent was consumed in the manufacture of chemicals, the big items being ethylene glycol, tetraethyl lead, carbon tetrachloride, trichlorethylene, sodium hypochlorite and calcium hypochlorite. The remaining 10 per cent of production was used for

water treatment, sewage disposal, textile processing, metals refining, etc. Chlorine derivatives which have felt the squeeze are chlorinated solvents and chlorinated hydrocarbon refrigerants, both of which are under mandatory control. Chlorine for defense is procured under Order M-19 and essential civilian needs are safeguarded in OPACS program for chlorine Title 32 Chapter XI part 1335.1. To obtain priority under these orders, a consumer need merely present his supplier with suitable documentary evidence of his classification. Borderline cases are decided by OPM. Additional capacity will come into production in 1942.

Plastics—Certain raw materials for plastics, notably phenol and formaldehyde are difficult to obtain. Distribution of formaldehyde is directed by OPM. Estimated production of formaldehyde for 1941 is about the same as for 1940 and is near capacity. Plastics consumed 70 percent of the supply in 1940, 74 percent in 1941. Direct military requirements are small, but indirect needs are great. Additional capacity is under construction.

Phenol production has been increased from 96,000,000 lb. in 1940 to an estimated 1941 production of 130,000,000 lb. of which 105,000,000 will be synthetic. Still the demand exceeds supply and OPM is endeavoring to bring about an equitable distribution of the supply. The big demand is not in picric acid as was expected a year ago but is in plastics for the defense program. Plastics now consume 60 percent of the production and the proportion is increasing. After Dec. 1 no deliveries of phenol may be made except as specified by the Director of Priorities.

Solvents—Present rate of production of methanol is 30 percent above 1940 production. The serious situation earlier this year on formaldehyde resulted from diversion of methanol capacity to ammonia but new ammonia plants coming into production are expected to rectify the situation. Direct military needs for methanol are not great in comparison with civilian needs.

A serious shortage of ethyl alcohol might have resulted but for the diversion of 60,000,000 gallons of whisky distillery capacity to industrial alcohol. Defense needs are still not as great as anti-freeze requirements. The total civilian uses are divided roughly as follows: antifreeze 41, solvents 16.4, lacquers 8.2, chemicals 8.2, pharmaceuticals 4.1, toilet preparations 4.1.

With three new producers entering the field in 1941, the production capacity for ethylene glycol has nearly doubled. Military needs, small now, will no doubt increase as the number of liquid cooled bombers increases.

Tanks and trucks also need antifreeze. A special high grade glycol has been developed for use in high temperature engines. Ethylene glycol also finds an important outlet in antifreeze for dynamite.

Synthetic Rubber—Total productive capacity for synthetic rubber had been increased to an annual rate of 17,000 tons in September with further construction still under way. This total does not include the insulating resins, Koroseal and Vinylite, now being produced in unprecedented quantities on army and navy orders. All these materials are under strict government control and distribution is effected entirely by allocation.

Alkalis—Soda ash and caustic soda are basic chemicals in which no shortage has developed. As in the case of many other items, producers are regarding sales with watchful eyes to prevent stock piling and excessive usage, but all real needs have been satisfied with little difficulty. New capacity is being built for both commodities in anticipation of larger defense requirements. Present capacity is about 10,000 tons per day of soda ash and 5500 tons of caustic divided 3 to 2 between electrolytic and lime-soda.

Mineral acids—Isolated cases of inability to obtain hydrochloric, nitric and sulphuric acids have been reported. In general these cases resulted from lack of proper commercial contacts rather than shortage of supply. OPM cannot be of assistance in such cases and merely instructs the purchaser to seek other sources of supply.

Ammonia—The nitrogen situation in the United States is delicately balanced. The more optomistic analysts believe that nitrogen will remain easy for another year; however, so many factors are involved that no specific statement can be made. Most important factors are: (1) how the big ammonia plants will operate, (2) whether new plants will come in as scheduled, (3) to what extent transportation for imported Chilean nitrate can be provided, (4) how much cyanamide can be brought from Canada, and (5) how much nitrogen must be exported.

Materials Under Distribution Control

Material	Date Effective
Aluminum	March 22
Magnesium	March 24
Tungsten	March 26
Neoprene	March 28
Nickel-bearing steel	April 10
Nickel	May 15
Borax and boric acid	June 9
Expired	Aug. 30
Cork	May 31
Copper	May 29
Polyvinyl chloride	June 9
Zinc	July 1
Cotton linters	Aug. 10
Synthetic rubber	June 9
Tungsten high-speed steel	June 11
Rubber	June 20
White sidewall tires	Aug. 8
Tricresyl and triphenyl phosphates	Aug. 30
Pig iron	Aug. 1
Chromium	July 7
Chlorine	July 26
Calcium silicon	July 29
Steel	Aug. 9
Silk	July 26
Vanadium	Aug. 14
Formaldehyde, paraformaldehyde, hexamethylenetetramine and synthetic resins	Aug. 23
Silk waste	Aug. 8
Phenols	Aug. 30
Chlorinated hydrocarbon refrigerants	Aug. 22
Tungsten	Aug. 31
Ethyl alcohol and related compounds	Aug. 28
Methyl alcohol	Aug. 28
Potassium perchlorate	Aug. 28
Toluol	Aug. 28
Phosphorus oxychloride	Aug. 30
Manila fiber	Aug. 29
Rayon Yarn	Sept. 13
Chlorinated rubber	Nov. 1
Phenols	Dec. 1

Materials Under Price Control

Material	Date Effective
Used machine tools	March 1
Aluminum scrap	March 24
Zinc scrap	March 31
Iron and steel scrap	April 3
Iron and steel products	April 17
Combed cotton yarns	May 26
Nickel scrap	June 2
Hides and skins	June 16
Pig iron	June 24
Cotton gray goods	June 28
Brass mill scrap	July 22
Raw silk	Aug. 2
Douglas fir plywood	Aug. 5
Copper	Aug. 14
Raw sugar	Aug. 14
Tin	Aug. 16
Burlap	Aug. 16
Copper scrap	Aug. 19
Formaldehyde	Aug. 20
Crude oil (Penn.)	Aug. 23
Rayon gray goods	Aug. 25
Animal hair	Aug. 27
Southern pine	Sept. 5
Anthracite coal	Sept. 12
Ethyl alcohol	Sept. 15
Acetic acid	Sept. 29
By-product coke	Oct. 1
Douglas fir	Oct. 1
Waste paper	Oct. 1
Paperboard	Oct. 1
Carded cotton yarns	Oct. 1
Methanol	Oct. 10
Hides and skins	Oct. 22
Zinc scrap	Oct. 18
Acetone	Oct. 27
Butanol	Oct. 27
Wastepaper	Oct. 30
Glycerine	Nov. 10

Adapting Processes to Defense Needs

EDITORIAL STAFF REPORT

Washington is undertaking to assist chemical process industry by encouraging new methods and processes. The purpose is to keep the flow of chemicals and industrial materials uninterrupted in a time of great confusion. In this article certain types of adjustments accomplished by this "makeshift" chemical engineering are briefly described. An evaluation of these is not undertaken nor is that important. By suggesting the way in which some adjustments have been achieved, it is hoped that many other changes, life-saving for some special industry, can be developed.

MAKESHIFT chemical engineering is necessarily fashionable. It is no longer safe to judge a process or a plant method on the basis of relative economy alone. Far more important is the question as to whether such a process or method can be worked at all, that is, whether the raw materials, the operating equipment, and the markets continue available. Thus the sound chemical engineering economies of yesterday are discarded temporarily in many cases.

Interlocking industry is contributing much, both to the complexity and to the solution of these problems. It is extremely important to realize that a small change in material supply or in process or in production may completely upset many of the divisions of interlocking industry. Thus, a casual change is not safe. Considered change may be necessary. But the effect of that change on the customer and the customer's customers is extremely important.

ANTI-FREEZE DEVELOPMENTS

The interlocking and interdependence of chemical process industry has also produced its advantages. Perhaps in no case has there been a better example of this than in the teamwork which has developed with reference to anti-freeze. Formerly there were four important commodities used to prevent automobile radiator freeze-up, alcohol, methanol, glycol, and glycerine.

Other requirements for glycerine have largely eliminated that chemical for several years. It can be synthesized, to be sure; but the need has not yet become great enough to substitute that method of manufacture for the normal production as a byproduct of soap making. Should the demand become urgent enough, there are several processes available. But they will come into action to supplement byproduct output only under urgent needs far greater than those yet experienced, especially as anti-freeze.

Glycol for anti-freeze was produced and distributed to a limited extent early in 1941. But during the summer it became evident that urgent military demands far exceeded the prospective supply. Producers, therefore, gradually shifted over from packaging for retail distribution. And we are now 100 percent on a defense supply basis. Any potential increase in capacity that can be made a reality will still not give any military surplus.

Everyone in the plastics business knows the trouble experienced in getting methanol. This was more than a raw material story. It represented a dramatic shift in manufacturing methods. Formerly a great deal of the methanol was made in plants which had had ammonia as the first objective of design. The demand for ammonia was even more urgent than that for methanol. Hence these synthetic units in certain works have been or are being shifted back to their original purpose of making synthetic ammonia for the explosives program. This has necessitated a rehabilitation and continuance in operation of some methanol plants that would otherwise have been closed down before now. Increases in capacity in new plants have also been arranged. Even so, all available methods for making methanol from wood and by synthesis still fail to satisfy the need. Hence glycerine, glycol and methanol from ammonia plants were quickly eliminated from the picture.

Some people have said glibly that we should re-open some of the old wood distillation plants and make more wood methanol. As a matter of fact, all of the operable capacity of the wood distillation industry is already working. Even if we had more ovens available for wood processing at these plants we would not have dry wood available to carbonize. And these plants have generally few pre-driers. Hence, they cannot do what is known as "hot lumbering," that is, use green wood direct from the forest. It is easier to build a millon gallons of new synthetic capacity than to arrange any makeshift whatsoever for increasing facilities for production of the equivalent methanol.

All of these developments throw the whole job of anti-freeze supply on the alcohol industry. That industry was already overloaded. Defense and essential civilian requirements have stepped up the production far above 100 percent of supposed capacity. Actually during the early fall of 1941 the alcohol plants were being operated at the rate of 20,000,000 gal. of industrial alcohol per month. This is more than double recent industrial demands; but still not enough for defense. Thus, it became rather obvious that the anti-freeze supply could not come from this source. Government officials un-

dertaking to care for civilian supply had to look elsewhere for radically different processes to meet the need for the 1941-42 season.

INDUSTRIAL ALCOHOL

Whiskey distillers were brought into the picture at this stage. They were asked to survey their plant possibilities. They agreed that they could make a great deal of 100 proof alcohol, that is, 50 percent by volume. Some of them agreed that they could make 190 proof. They were asked to do so. The raw material was arranged by transferring 20 million bushels of corn from government surplus stocks. The individual beverage plants were given contracts to process this corn into industrial alcohol. To a limited extent equipment was modified. Generally speaking, it was a matter of adapting chemical engineering methods to the new job rather than elimination of old processes and establishment of entirely new procedures. But it did require some radical adjustments in plant practice.

The result is expected to be a supply of industrial alcohol from a new source at the rate of four million to five million gallons per month as the plan gets into full action. This is just about enough alcohol to care for the anti-freeze needs of American motor cars. One could, therefore, say that we are mixing the whiskey business with the gasoline business with great safety. We are putting a product of the whiskey plant in at one end of the car and of the petroleum refinery at the other and thus arranging to keep America's 30 million passenger vehicles moving safely in cold weather for another year.

CHLORINE

Rationing of chlorine illustrates one of the ways in which new chemical engineering is going to be built up. Quite a number of chlorine users in the paper industry have made their own bleach material. Some of these companies have thought they should be allowed to retain their own production of bleach for use in their own pulp and paper mills. That is not the plan. Chlorine is so essential for so many purposes that even those who make their own chlorine or bleach will be expected to share in the responsibility of supplying necessary users, even at the expense of their own business. The result is the need for rather radical new developments in these paper and pulp plants for the recovery of chlorine in shippable form. In most cases recovery of liquid chlorine for cylinder shipment is neither necessary nor practical. Hence, the making of concentrated bleach is planned.

Nitrogen supply in usable chemical form is vital to much of process industry. Ammonia supply for explosives has, therefore, upset the economic balance elsewhere quite frequently, and seriously. There has been some thought that those who use ammonia for making nitric acid or nitric fumes used in sulphuric chamber plants, could well go back to the old niter pot. That change in process is technically possible if Uncle Sam will make sure that there are enough ships to bring the Chilean nitrate to the United States. But that assurance is not too easily given. That is one of the reasons why the ammonia programs of the Ordnance Department have accounted for about 1500 tons per day of new synthetic ammonia capacity in the United States.

NITROGEN CHEMICALS

Shortage of ammonia hits many groups, but none more seriously than the fertilizer industry. Just when the impact of ammonia shortage will become significant there is not yet clear. It depends on the relative speed of completion of synthetic ammonia plants and of explosive plants which need the ammonia. But by next spring it is feared that there will be little or no ammonia to go to fertilizer works for the ammoniation of superphosphate. That means that the fertilizer man will have to step backward in his practice to the old, slow den processes of curing. This means that the production at the active shipping season next year may not be anything like as great as the industry would like.

Coke oven concerns are considering a radical modification of their practice as a result of this fertilizer situation. They are wondering whether it will not be economic to recover much more of their ammonia from coke oven gas as liquor, and less as ammonium sulphate. Where "lime stills" are available, this liquor can be concentrated up to shippable strength, or anhydrous ammonia can be made from it. Thus the coke works would be able to send ammonia to the fertilizer man for direct ammoniation of superphosphate. The cost would be considerable. But cost considerations are not always dominant these days. Coke and gas men generally will have to answer this question for each individual location. Generalization is not safe.

Considerable choice in methods of making ammonia for nitric acid have been considered by the government in its Ordnance projects. Generally speaking, direct ammonia synthesis is the only process which has had serious study. Some reserves of Chilean nitrate are being developed. But they do not form a significant part of the total of the program. Within the synthetic group of processes there have been several choices. All American builders of equipment have been devising the latest and the best methods for these Army plants. For example, some very radical changes in catalyst chamber construction have been seriously studied.

The source of hydrogen for ammonia synthesis has varied considerably also. This hydrogen may be made either from natural gas, as a petroleum byproduct, or from coke by the water-gas process. In one important plant the government expects to get the lowest cost hydrogen by using a byproduct of carbon black manufacture. Thus, what is commonly criticized as one of the most wasteful chemical processes of the country is being turned to advantage in the defense program.

TOLUOL

Several new process developments have had important meaning in the toluol program. Even before the United States undertook its TNT projects the demand for toluol exceeded the normal supply in this country. Thus a speed-up of production by normal plant operations had been undertaken by city gas and coke oven operators. One important improvement in yield was achieved by adding oil to the coal charged to ovens. A very creditable increase in output has resulted where that process has been applied.

But the big new supply of toluol for defense manufacture is going to come from the petroleum industry. The modern high-test aviation gasolines contain substantial percentages of toluene and related aromatic hydrocarbons. Good chemical engineering has permitted the diversion of a small percentage of this aviation gasoline from the plane fuel tank into the toluene supplies for TNT making. Some of the highest grade distillation equipment built in recent years has been very cleverly applied here.

The toluol program has also been interlocked with the synthetic rubber situation. One of the outstanding successes in the making of butadiene has been the work of certain companies who have been doing oil cracking un-

der closely controlled conditions, simulating oil gas manufacture. The mixed liquid product of such processing includes substantial percentages of toluene. Hence that commodity is an important byproduct from butadiene.

Electrometallurgical processes of extreme and radical form have found application in the defense program. Most conspicuous has probably been the new development of magnesium metal processes. The Dow work described elsewhere in this issue has pioneered the way. Varied methods of important chemical engineering significance are being applied in other plants previously described, but some are not yet open for description to the public.

MAGNESIUM AND CHROMIUM

Development of raw material for magnesium manufacture from sea water is resulting also in important service for the refractories industry. Two important plants are projected for construction immediately. One of these will use sea water and dolomite, the other a chemical byproduct brine with dolomite. The precipitated basic magnesium carbonate will thus come in part from the mineral and part from the water or brine used. It will become the raw material of magnesite refractory manufacture. Thus the refractory makers are virtually declaring their independence of remote or foreign supplies of magnesite mineral.

Independence of other foreign mineral supplies is also an important responsibility of several industries. An extensive series of pilot plant studies in Nevada give promise of important commercial development of domestic low-grade manganese ores. The work of the Bureau of Mines with the aid of important industrial advisers seems to indicate that when the dollar sign is not dominant, we can depend to a substantial degree on our own manganese reserves.

To some extent domestic chromium ores are also going to be used. They are to be applied at least for the making of chromium chemicals. Thus we shall be able to carry on the normal chrome tanning processes of the leather industry. For a time there was talk in Washington that the leather tanners would have to do without chromium. But those who advocated that change in process casually soon found that it might be even more difficult to get a sufficient supply of vegetable tanning materials than it was to get the chromium chemicals needed. Some substantial shifts are being made between the chrome and vegetable tanning in some special divisions of the industry.

Beneficiation of low-grade Arkansas bauxite is also definitely under way. It appears to be proven by laboratory-scale work that flotation will give us workable ore as a substitution for the higher grade imported bauxite which comes from South America. Here again the shift is being made to a considerable extent without too much regard for dollar considerations.

Administration of the many official problems raised by changes in process and product is not easy. Washington has, however, established the policy of expecting industry to do most of its own thinking, reserving its official authority for use when the good sense and skill of industry executives and engineers break down. It appears, however, that some rather drastic actions are to be expected. Many changes of industry practice are going to be necessary as the result of certain shortages.

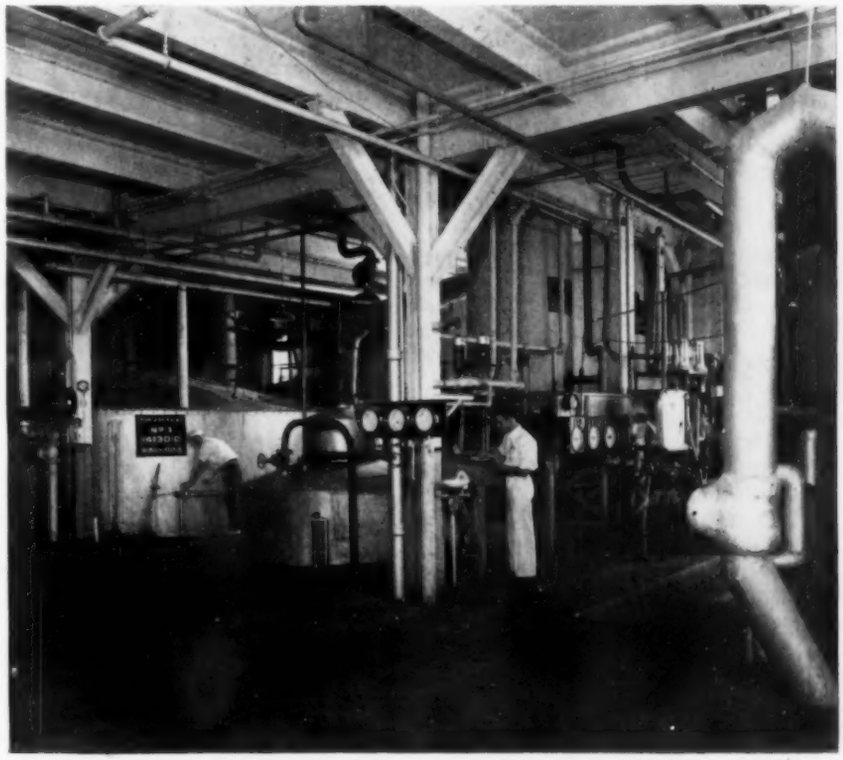
Officials glibly urged substitution of plastics for light metals a year ago. Now there is no glibness. No matter what effort is made, we are not able to get enough plastics raw materials. Adaptation of processes to the use of plastics instead of metals is, therefore, futile in many circumstances, although there are cases where such substitution has helped considerably.

GENERAL WARNING

This sort of situation makes necessary one general warning. When a change of process or manufacturing procedure is considered, it is not safe to study only present situations. It is very important to trace back to their origins all of the needed materials of construction and the needed raw materials for the process. The contingencies which will affect all of these should be studied before change from old to new process is adopted. If this is not done, many changes may prove to be a jump from bad to worse.

It cannot be too strongly emphasized that the interlocking of process industry is going to make many rather amazing changes possible. But it is equally important to remember that this interlocking of many industries makes the trouble of one become promptly the trouble of many others also. It is never safe to disregard these ramifications as shifts for a single plant or a single process are being considered.

Equipment similar to this has been changed from whiskey to industrial alcohol manufacture. Some 20 million bushels of corn from the Government surplus stock will be converted to industrial alcohol at the rate of 4-5 million gal. per month to help take care of the nation's anti-freeze needs



Meeting the Man-Power Shortage

EDITORIAL STAFF REPORT

Many chemical manufacturers are already faced with serious shortages in technically-trained personnel and some are feeling the pinch in unskilled and semi-skilled labor. This situation will soon become more serious as the industry gears itself completely to an all-out war-defense economy. Now is the time for every chemical and process plant to estimate its future man-power requirements and to take decisive measures to meet these needs. In the following pages are suggested certain steps that can be taken to absorb the shock of the shortage in chemical man-power.

FEW PEOPLE REALIZE the stupendous effort by various agencies of the Federal Government to provide for defense job training. Programs under the U. S. Office of Education alone call for training of over 3,800,000 workers during the fiscal year 1941.

ENGINEERING DEFENSE TRAINING

Purpose of these courses under the Engineering, Science, and Management Defense Training (E.S.M.D.T.) program of the U. S. Office of Education in cooperation with accredited engineering colleges is to provide qualified persons for engineering occupations essential to defense through short courses supplementary to employment or intensive full-time courses to train qualified men for engineering work. Persons eligible include (1) those with college engineering training or equivalent, (2) those whose training in mathematics includes trigonometry and allied subjects, and (3) those whose work experience indicates that they may benefit from the courses.

Any chemical manufacturer desiring further information on the engineering defense program is urged to consult (1) the nearest accredited engineering college, (2) any office of the State Employment Service, (3) the nearest regional advisor on E.S.M.D.T., (*Chem. & Met.* report on "Chemical Man-Power for National Defense," January 1941). Information will also be furnished by Mr. R. B. Farrabrant, specialist in engineering education, E.S.M.D.T., U. S. Office of Education, Washington, D. C.

Training-Within-Industry Program—Another government training program, under the supervision of the National Defense Advisory Commission, is designed "to assist defense industries meet their man-power needs by training within industry each worker to make the fullest use of his best skill up to the maximum of his individual ability, thereby enabling production to keep pace with defense demands."

Chemical manufacturers wishing to institute "training-within-industry" and "up-grading" programs or who wish assistance on the programs already under way in their plants, should write the Training-Within-Industry Branch, Labor Division, Office of Production Management, Washington, or contact any one of the field service agents.

Other Training Courses—The regular vocational training program, administered by the U. S. Office of Education and the State Boards for Vocational Education, intends to train 2,250,000 persons during the fiscal year 1941 for a large variety of vocational skills. In addition, other job training courses for defense work administered by the Office of Education and State Boards, include those for less-than-college grades. The trade and industrial program of this division includes the "pre-employment refreshers" designed to train 250,000 enrollees for single-skill beginners' jobs in defense occupations and the "employment supplementary" courses to train 350,000 persons now employed for more responsible jobs by improving their skill and knowledge of the trade.

WHAT INDUSTRY MUST DO

Training Within Industry—First step for the chemical plant to take is to initiate its own independent program for the training of apprentices and unskilled labor to do competent work of a semi-skilled nature.

Ordinarily it takes from six months to two years for proper training of the average employee in a chemical plant, either technically educated or untrained. Under the present emergency, this training period should be intensified and probably shortened to two to six months for specific and relatively simple operations.

What specific types of chemical work can these men best undertake? Simple jobs for which emergency training of a month or less should be sufficient include packaging and sampling operations, loading and unloading tank-cars, routine analysis of a single product, simple control observations, filter press, centrifugal, screening and other simple materials handling and unit operations. More responsible jobs requiring longer training and exercise of more judgment include analytical control work, quality inspection, instrument reading and manipulation, quantity measurements and the more complicated types of processing and handling operations.

UP-GRADING WITHIN INDUSTRY

Related to and dependent upon the program of training-within-industry is that of up-grading. The training phase should come first in order to supply labor material to fill the shortage in the lower ranks created by up-grading. The two systems, operating in conjunction, can probably go 75 percent or more of the way to ease both skilled and unskilled labor shortages in the chemical plant.

Up-grading simply applies the automatic shifting of an employee or group of employees from one level of work to another level one or more grades higher. Of all the devices for stabilizing labor conditions, up-grading is the most flexible and reliable. General up-grading of employees has among its advantages the following:

1. It improves the morale of the experienced personnel provided, of course, that pay is adjusted upward in proportion to responsibilities;
2. It causes little loss of efficiency or disruption of normal operations since those up-graded are already somewhat familiar with their new duties;
3. It is flexible and can be so worked that a moderate shortage anywhere along the employee scale, with the exception of basic unskilled labor, can usually be adjusted with a minimum of dislocation;
4. It places the new and unknown personnel at the base of the labor scale where training is easiest, mistakes are least expensive and industrial sabotage most difficult.

Transfer of Personnel — Many chemical companies have in recent years built up a considerable sales force of chemical engineers, chemists and other technically trained men. Many of these, especially the chemical engineers and industrial chemists, could fit into production work and thus help relieve shortages of technical men at a time when emphasis is on production instead of sales.

It is estimated that the larger chemical concerns in this country spend from 25-40 percent of all their research effort and expenditures towards "reducing the cost and improving the quality of present products." This work excludes efforts toward basic improvements in processes or products but includes that done primarily on cost reductions to achieve a slight advantage in a competitive market as well as that toward improving the quality or appearance of a product primarily for sales reasons. Such research efforts are meritorious under normal conditions but are hardly "essential" in a war economy. Furthermore, those in this type of work are usually chemical engineers or others familiar with plant operating conditions. This proportion of "non-essential" research is even higher with the smaller chemical concerns who are, as a rule, least capable of solving acute labor shortages.

Women Workers—During the first World War, a considerable number of women were employed by the chemical industries to help fill the gap caused by Army requirements. A similar situation may arise again and women can still help considerably in relieving labor shortages.

Women would probably be of best use in small chemical plants and with distributing concerns. They fit well into such plant jobs as weighing, packaging, wrapping and labeling small-container chemicals, routine and analytical laboratory control work, product inspection, storehouse clerking, supply supervision, drafting, and small-batch kettle operations.

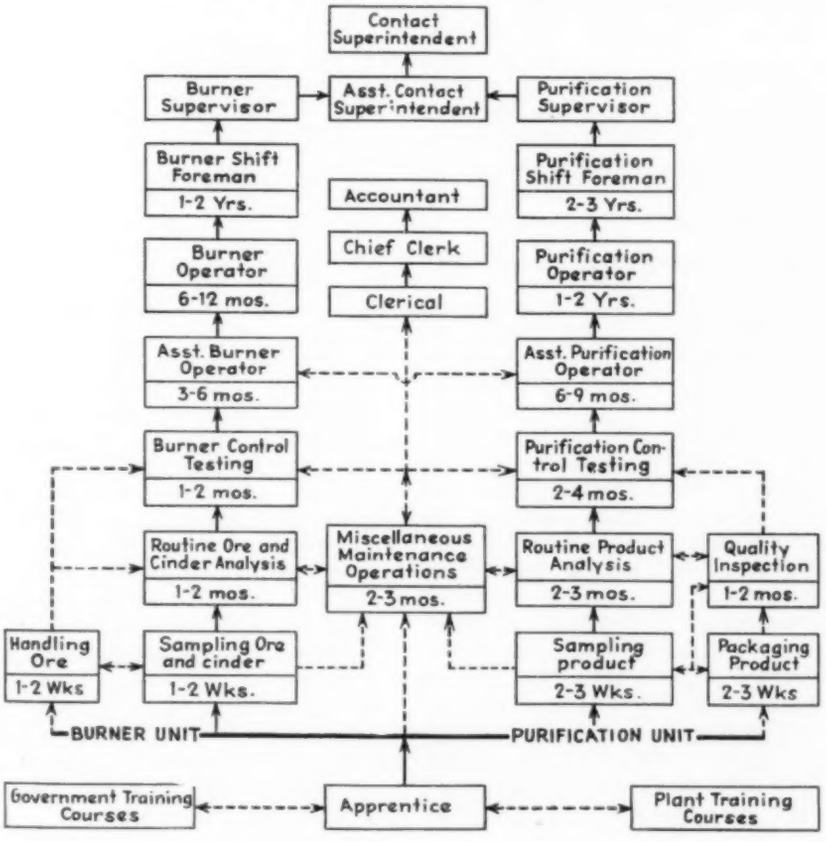
Working Conditions—In times of stress, overwork and bad working conditions multiply losses in man-hours resulting from sickness, absences, accidents and general lowered working efficiency. The Industrial Hygiene Foundation of America, Inc. and other similar organizations can give valuable suggestions for increasing productivity by reducing health hazards.

Already it has been reported that industrial accidents in the nation have increased 20 percent as a result of expanded production for defense. Employers should make every effort to prevent this from becoming even higher, not only because of the lives and property losses involved, but also because accidents slash production schedules and aggravate problems.

Miscellaneous Factors—Other factors that are individually small but collectively important in increasing man-hour productivity in chemical plants can be listed as follows:

1. Increased standardization of products, packages, equipment and operations;
2. Maintenance of high morale among all workers at all times;
3. Increased use of automatic and semi-automatic control and continuous processing in place of batch operations;
4. Proper maintenance of all equipment and buildings;
5. Elimination of unnecessary testing and inspection and adoption of short-cut methods of analysis;
6. Encouraging employees to register for outside courses in chemical defense work.
7. Maintenance of proper relations with labor unions.

Possible lines for training and up-grading operating personnel in a large contact sulphuric plant, with heavy lines indicating the normal up-grading procedure and dotted lines the alternative courses. Approximate training periods for each type of job before up-grading are indicated



Technical Data Under Export Control

CAPT. W. E. ELLIOTT, *S.C., U. S. Army Chief, Technical Data License Division, Office of Export Control*

EXPORTATION of descriptive and informational material pertaining to any process, synthesis, or operation in the production, manufacture, or reconstruction of articles or materials or constituents thereof designated by the President as necessary to the national defense pursuant to section 6 of the act of Congress approved July 2, 1940, must be licensed.

Industry again is called upon to win a war. The business of operating lathes, mines, wells, and work benches of the "arsenal of democracy" is world important, and no less so are the secret processes of industry.

A news release states that the British have found a way to combat night bombers. Another informs us that the United States has a way to detect submarines. A picture in a recent publication showed the uncanny accuracy of a certain bombsight. All of these devices germinated in someone's idea. Hence the necessity of keeping even ideas well guarded.

Because our constitution guaranteed to an investor of a new idea, protection for a limited period, a private monopoly in effect protected by law most good ideas find their way into the Patent Office. Some are made secret in the interest of defense. Others are not, but we still do not want them made public. A three-dimensional drawing on a blueprint may tell a better story, present a clearer picture, than 50 pages of description.

In order that exportation of technical data of a critical nature may be regulated, the President on Mar. 4, 1941, by Proclamation No. 2465, determined that any information of a descriptive character pertaining to any of the more than 150 basic commodities then under export control, unless "generally in a form available to the public", must be licensed prior to its export.

The proclamation covers informational and descriptive material such as pictures, designs, blueprints, specifications, operating and installation instructions and the like pertaining to items which are under control. It was intended to be extremely broad and to include anything which can be used or adapted for use in the process, synthesis, or operation in the production, manufacture, or reconstruction of any articles or materials the export of which is controlled, or any basic or intermediary constituent of any of such articles or materials. The clauses were designed to catch loop-hole seekers who might desire to slip secret and critical information out of the country, but were not to be regarded as curtailment of legitimate business.

The Office of Export Control, Economic Defense Board, supervises both the export of the materials, supplies, and commodities, and the technical data pertaining to them (except patent applications for filing in foreign countries on inventions made in the United States, on which licenses are issued by the Commissioner of Patents.) The Economic Defense Board works in constant contact with the Departments of State, War, and Navy, Office of Production Management, and all the other agencies of government that have been welded together to produce a defense program in these perilous times. There is a considerable body of experts to call upon, including those in the Post Office Department and the Customs Service.

ARTICLES, MATERIALS, COMMODITIES

The articles, materials, and commodities under export control are grouped in a half-dozen categories: (1) Munitions, including everything that the President by his proclamation of May 1, 1937, had so termed in the various categories ranging through rifles to great cannon, vessels of war, aircraft, revolvers and ammunition, chemical warfare items, explosives, and all the appurtenant things that make warfare possible. Then come (2) chemicals and drugs of which there is a list exceeding two-hundred items including the salts of many metals. The field of (3) metals is a large one and includes most of the known metallic elements, starting with aluminum and running right down through the list, with few exceptions, to zinc and this also includes ferro-alloys. (4) Machinery is another item and embraces metal-working machinery, measuring, balancing, and gaging machines, well and refinery machinery, mining and hoisting machinery. Pumps, ball bearings, and tools incorporating industrial diamonds, fall into this general category as well. Then (5) petroleum and its products represent a distinct division and, last, but quite inclusive, there are (6) manufactured goods and other items that do not fit exactly into any of the other categories. Here are found abrasives, nylon, flax, jute, shellac, leather of various types, wood pulps, kapok and cork. And just to prove that the grocery man has not been overlooked there are animal and vegetable oils, which is quite a field in itself. Also listed are rubber, graphite, carbon black, pine oil, and a considerable variety of other materials.

MUNITIONS DEFINED

The proclamation of May 1, 1937, defining munitions was specific, and it follows that any technical data pertaining to any of the items therein mentioned must be licensed or the sender is liable to the law. However, the field covered by the term "technical data" is no larger than the group of articles or materials listed in schedules to which it pertains.

The Office of Export Control determined that the broad term "machinery," as contained in the proclamation of Apr. 14, 1941, includes ball and roller bearings. It also specifically determined at the same time that because they are only an element in such machinery, the machine itself, just by reason of its inclusion of roller bearings, would not be under export control unless it was a type of machinery expressly described by the Office of Export Control in one of the export control schedules. Consequently, technical data pertaining to a machine containing ball bearings would not be under control unless the machine in its entirety had been subjected to the licensing requirement.

On July 2, 1940, the first list of commodities to fall under export control was published by presidential proclamation. Eleven chemicals appeared in this list. Subsequent schedules have put long additional lists of chemicals and drugs expressly under export license control. Most metals are under control —and with that control is included their salts which come within the chemical field directly.

Just how broadly is export control applicable to any particular field? In early schedules the extent of many categories was specifically limited by words such as "includes only." This working appears under the general class: Aircraft—Parts, Equipment, and Accessories. However, as the necessities of the control have expanded so have the basic general categories been extended. Originally the only salt of aluminum for example, was "aluminum chloride, anhydrous." Pursuant to Schedule 17, effective Aug. 29, 1941, all salts of aluminum are now under control as commodities and the control of technical data pertaining thereto follows in course. The broadening scope of national defense has necessitated similar extension of controls in a number of other categories.

The phrase "in addition to those listed in previous numbered Export Control Schedules" appears now as a rule rather than an exception. Hardware is a good example. Anything that falls into that general category is now under control, for the schedule starts out with the general term "hardware," recites several items and subclassifications of hardware such as car and marine hardware, and ends with the words of inclusion "other hardware." A careful perusal of the schedule itself is necessary in every instance to ascertain its relation to technical data subject to export license.

As of Aug. 23, 1941, the Office of Export Control has published 20 schedules, of which schedules Z and Y apply only to certain "blocked nationals." On the first of each month a comprehensive schedule dealing in detail and specifically with all the various basic commodities of these interim schedules is published. The technical data about a considerable body of materials subjected to license in these schedules are not regarded as so critical as to require its submission to the Office of Export Control for individual licensees prior to export. These technical data include such items as heating equipment, metal furniture, routine matter concerning rubber tires and the like. To areas under the control of the British Empire such as Australia, New Zealand, Newfoundland, and South Africa, and to Iceland, Greenland, and the Philippine Islands, technical data pertaining to this type of material are permitted to go under general license by complying with the requirements which are set out in detail in all comprehensive schedules.

EXPORTING WITHOUT LICENSE

Many technical data pertaining to all these materials fall under the exception of "being generally in a form available to the public." As such it can be exported without license.

Technical data pertaining to "aviation lubricating oil" is under export control. There are many patented processes pertaning to aviation lubricants. Copies of the patents describing these processes can be obtained from the Patent Office for 10 cents each. That type of material, if placed in an envelope and addressed to a man in a friendly foreign nation would not have to be licensed, because it is "generally in a form available to the public." Perhaps the consignee doesn't understand the terms of the patent description and cables the United States exporter asking for his expert opinion as to what certain language in the patent means, how to carry out the process, or how to install the equipment described in the patent. This particular United States citizen's opinions cost money—he does not publish them but sells them for good fees. Obviously his opinion as a consultant is *not* "generally in a form available to the public" and so, although this applies to a patent which is "generally in such form as to be available to the public," his opinion as a consultant is not, and it must be licensed.

The opinion, attached to an Export Control Form No. 16 (green form), must be forwarded to the Office of Export Control for action. These green forms are available at most of the larger post offices and at the field offices of the Office of Export Control in New York, San Francisco, and Los Angeles, and upon application by mail to the Office of Export Control, Commerce Building, Washington, D. C.

Due to the changing needs of national defense as regards export of vital information, the policies of export control have to be modified from time to time to carry out the purposes of the Export Control law. Therefore, all persons affected by the present regulations are advised to consult the Federal Register for such new regulations as may be published from time to time, or to address specific questions to the Office of Export Control, Economic Defense Board, 2501 Q Street, N.W., Washington, D. C.

Defense Industrial Facilities, Value of Industrial Facilities Financed with Public and Private Funds, By Type of Product and Source of Funds

Through Aug. 31, 1941

Type of Product	Total		Source of Funds: Public [1]		Source of Funds: Private [2]	
	Number of Plant Expansions	Estimated Cost	Number of Plant Expansions	Estimated Cost	Number of Plant Expansions	Estimated Cost
		(Thousands of Dollars)				
Total	2,756	$4,725,786	575	$3,783,807	2,181	$941,979
Chemicals (including explosives)	118	643,364	33	578,497	85	64,867
Products of petroleum and coal	24	36,716	2	14,334	22	22,382
Iron and steel products	396	505,153	52	332,190	344	172,963
Ammunition, shells, bombs, etc.	274	831,832	97	790,621	177	41,211
Guns	162	305,417	71	279,441	91	25,976
Aircraft	308	908,764	139	809,712	169	99,052
Ships and ship repair	142	593,443	68	571,027	74	22,416
Vehicles and tanks	70	51,264	12	30,167	58	21,097
Non-ferrous metals and their products	117	327,810	21	175,424	96	152,386
Machinery (except electrical)	591	240,310	76	116,582	515	123,728
Electrical equipment	132	49,126	22	30,337	110	18,789
Miscellaneous manufacturing	198	87,109	21	55,075	177	32,034
Non-manufacturing	204	145,478	1	400	263	145,078

[1] Includes facilities estimated to cost more than $25,000 which are direct obligations of the War and Navy Departments (including financing through government supply and emergency plant facility contracts), Maritime Commission, Defense Plant Corporation, British Government, and loans of the Reconstruction Finance Corporation.
[2] As reflected by Certificates of Necessity approved. Excludes Pilot and Mechanic Training.
Note:—Number of expansions shown in all total columns is an unduplicated figure.

Reporting What's New in Equipment

EDITORIAL STAFF REPORT

With the approach of the Chemical Exposition, thoughts of chemical engineers naturally turn to the new tools available for carrying out chemical processes. In 1935 *Chem. & Met.* first tried a new technique of Chemical Show reporting, by covering new developments in advance so that Show visitors, forewarned, could spend their Show time most effectively. This year an even broader technique has been attempted—the covering of new developments of the past two years, whether those of exhibitors or of non-exhibitors, and whether they are to be exhibited or not.

ONCE AGAIN a Chemical Exposition is almost upon us, and again those chemical engineers who are able to do so will plan to spend as much time as possible at the Grand Central Palace in New York, during the first week in December.

For several years past *Chem. & Met.* has made a practice of "previewing" the new developments in equipment and construction materials to be shown at the Exposition, with the dual purpose of presenting a "Show-in-Print" for the stay-at-homes, and of making it easier for those who will attend the Exposition to plan most effective use of their time and shoe-leather.

This year new developments assume an even greater importance than in the past, as defense requirements make their tremendous demands on the process industries. Hence our decision to attempt an even broader approach to the What's New question. Not only did we go to all prospective exhibitors who were manufacturers of plant equipment or construction materials, and ask them what they had developed, but we went also to more than 200 non-exhibitors to assure complete coverage. We asked them to tell us of their new products of the last two years, whether or not these things would be shown at the Chemical Exposition.

Unfortunately, many of those approached were too much occupied with their own expanded affairs to work with us, and the result is that the story of the following 20 pages is by no means complete. However, much of importance has been uncovered and the effort has by no means been wasted.

CENTRIFUGALS

Most recent of the variations of the Bird continuous centrifugal, manufactured by the Bird Machine Co., South Walpole, Mass., is the centrifugal classifier which is used to effect particle size separations under controlled sedimentation conditions, using centrifugal force as high as 1,000 times gravity. Fine separations in the range from 1 micron to 200 mesh are the particular field of the machine and separations are claimed to be possible at the exact particle size desired.

The construction of the new classifier is similar in a number of ways to this company's solid-bowl continuous centrifugal. The feed slurry is delivered through a stationary feed pipe to a revolving truncated cone. A screw conveyor rotating within the conical bowl, at a slightly lower speed but in the same direction, picks up the coarse particles which are separated by centrifugal force and discharges them through discharge ports at one end. The classified fine particles are carried out at the other end with the liquid. The desired degree of separation is obtained by controlling the feed rate and the amount of centrifugal force. When a thoroughly drained coarse fraction is desired it can be made by reducing the pond depth so that the smaller end of the bowl is not submerged.

A continuous centrifugal of novel design which was introduced originally for the de-sanding of rotary oil-well drilling muds, but has since found its way into such operations as starch manufacture and the refining of finely ground clays, is the Merco, a product of Merco Centrifugal Co., San Francisco, Calif. Although this machine is of the valve type with continuous discharge from the bowl, it has the unique feature of recirculating the discharged material back through the bowl until the material has reached the density desired, when it is discharged from the machine. It can thus be used as a concentrator.

The Reineveld centrifugal which was announced to chemical engineers in this country at the time of the last Chemical Exposition, was at that time made only in Holland. Very recently arrangements have been completed by the Reineveld Corp. to build the machine at the Philadelphia plant of Welding Engineers, Inc. Features of the new machine, which is of the horizontal bulk type, are stated to include absence of vibration permitting the motor to be built in; fully automatic electric cycle control; ability to feed rapidly; continuous operation at constant speed; higher speed; lower power cost; and larger capacity. Immediate production of machines with 24-in. and 65-in. diameter bowls is contemplated while larger centrifugals will be manufactured later.

Three new varieties of centrifugal separators were developed by the Sharples Corp., Philadelphia, Pa. For clarifications where oxidation of the product is to be avoided, or where the formation of a foam is objectionable, the company developed a "no-foam" clarifier in which the clarified liquid is delivered from the bowl under pressure. This pressure may be utilized to do the work of a discharge pump. Another new model

is the company's high-capacity vapor-tight oil purifier, intended particularly for purifying large quantities of diesel fuel oil and lubricating oil for diesels and turbines. Still another new design is the Autojector, a high capacity separator having peripheral valves which open automatically to discharge solids as they accumulate. A higher percentage of solids in the feed is said to result in more frequent valve operation without adverse effect on bowl efficiency. This centrifugal was developed for applications involving a relatively large quantity of solids, coupled with the requirement for high separating force.

CRUSHING AND GRINDING

Abbe Engineering Co., New York, has developed an all stainless steel ball mill, the entire surface of which is jacketed for heating or cooling. The mill is provided with a circumferential discharge housing for dustproofness, feeding to a continuous inclosed screw conveyor. A gear-head motor mounted on a combination mill pedestal and motor base is used for the drive. The particular field for this mill is the grinding of materials which must be processed under heat or cold. Another recent development of this company is the design of a jar and bottle rolling machine which is a new type of small batch grinding and mixing device. The jars or bottles are placed on rotating rollers which are rubber-covered seamless steel tubes set in heavy bearings and driven by a gear-head motor.

Type R-636 is the designation of an improved Type R gyratory crusher added to its line by Allis-Chalmers Mfg. Co., Milwaukee, Wis. This machine is a high-speed gyratory with a crushing stroke designed for high capacity and a cubicle-shaped product. An interesting feature is the use of an integral hydraulic jack for adjusting the clearance between the head mantle and the steel concave ring.

A new mill recently completed by Eppenbach, Inc., Long Island City, N. Y., has been put out under the name of high-speed Aloxite grinding mill. This device, a vertical stone mill similar in appearance to a colloid mill, employs special synthetic aluminum oxide abrasive stone members for grinding and is said to be useful for extremely fine disintegration and for the handling of the more abrasive materials, such as paint pigments, and fibrous materials, such as coffee beans and wood pulp.

Gruendler Crusher & Pulverizer Co., St. Louis, Mo., has announced a new pulverizer known as the Super-Master. This high-speed hammer mill is designed for direct connection to a 3,600 r.p.m. motor and is generally furnished with a separate feeder motor. Electrical control for the feeder motor can be operated automatically according to the load on the pulverizer motor.

During the period under consideration, the Raymond Pulverizer Division of Combustion Engineering Corp., Chicago, Ill., improved its Flash drying method in certain applications by use of a cage-mill type of Flash dryer. The company also introduced a new 8-in. screen pulverizer to serve the requirements of either small commercial grinding applications, or laboratory use.

A multi-stage, fine-reduction crusher of the gyratory type known as the Traylor-Stearns, was announced by Traylor Engineering & Mfg. Co., Allentown, Pa. The crushing head in this machine comprises two separate manganese steel bell-head mantles of different diameters, assembled one above the other, with a common head center. The two concaves are separate.

DRYERS

Typical of a trend in drying which commenced with the drying and hardening of industrial finishes but extended also to applications on a variety of chemicals, was the use of infra-red lamps to produce the heat by radiation and thus minimize heat losses due to convection. Several manufacturers introduced such lamps. Low first cost of such installations and ease of moving and rearranging the oven structure are advantages claimed for this method.

Differing from both spray drying and the type of drying in which materials are dried and ground simultaneously in a mill heated with hot gases, yet in some ways related to both methods, is the new Turbulaire dryer developed by Western Precipitation Corp., Los Angeles, Calif.

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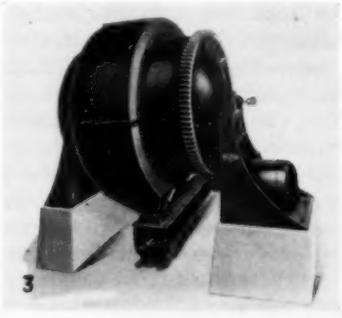
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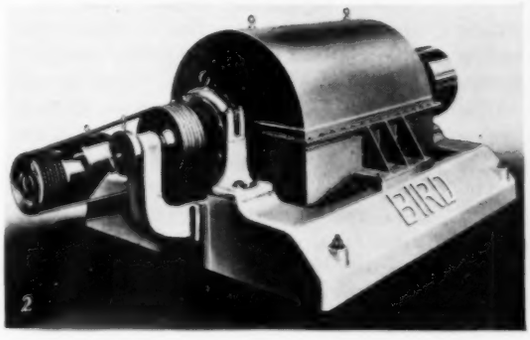
(1) Sharples Autojector automatic discharge centrifugal. (2) Bird centrifugal type continuous classifier. (3) Stainless steel jacketed ball mill made by Abbe Engineering Co. (4) Allis-Chalmers Type R 636 gyratory crusher. (5) Western Precipitation Turbulaire dryer



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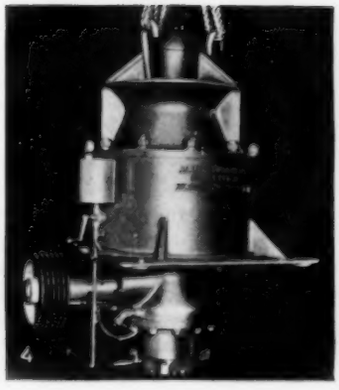
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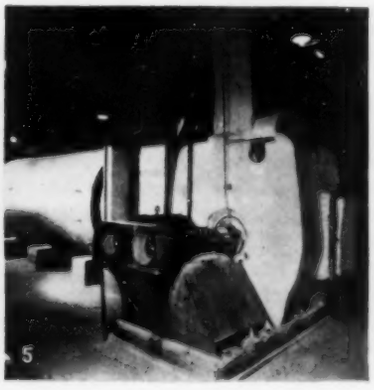
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Wet materials ranging from filter and centrifugal cakes, to slimes and pulps, can be handled in this equipment according to the maker. The wet material is mixed with partially dried material (and sometimes completely dried material), then is dried in suspension in a hot stream of air. The feed mixture from a pug mill mixer enters a dryer of simple construction where it is internally circulated by mechanical means in contact with the hot drying medium. Drying takes place in agitated suspension. Partially dried oversize particles are thrown down in an inertial separator for return to the pug mill for mixing with the incoming material, while completely dried material is removed from the circuit in a Multiclone separator.

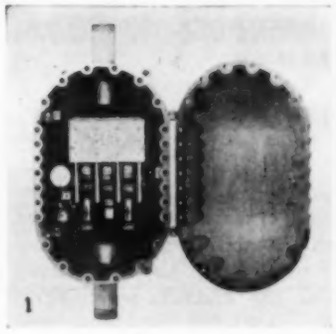
DUST COLLECTORS

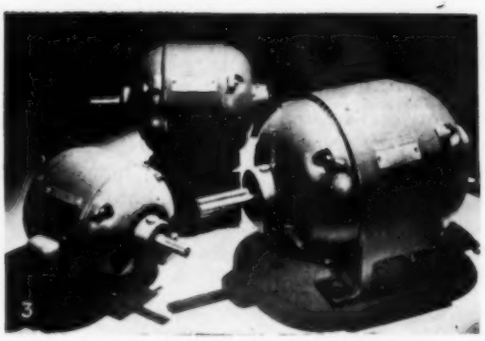
A recent addition to the line of dust collectors produced by Pangborn Corp., Hagerstown, Md., is a new unit type dust-collector family, with the cloth screens made up in banks over wooden frames, and these banks mounted in steel casings. The four sizes include one, two, three and four banks of filters. A one-bank portable member of the family is mounted on casters and employs a dust drawer for receiving the shaken-down dust instead of a hopper. All units are rapped mechanically.

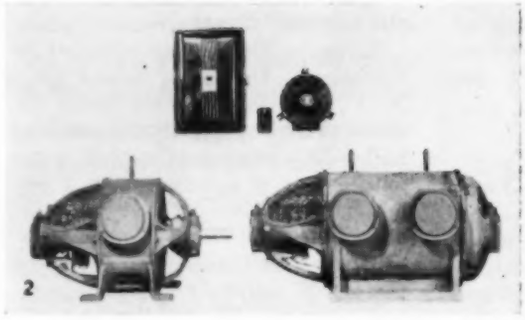
Since the last Chemical Show a unit design of wetted-cyclone dust collector has been introduced by Claude B. Schneible Co., Chicago. Similar in principle to this company's standard Multi-Wash dust collectors, the new unit type incorporates in one assembly all equipment necessary for air cleaning in capacities from 2,000 to 10,000 c.f.m., including in combination a wetted-cyclone collector tower incorporating two Multi-Wash stages and an entrainment separator stage; a sludge tank; a motor-driven fan; a motor-driven water circulating pump of special "wear-proof" construction with bearings above the water surface; and a motor-driven sludge conveyor.

ELECTRICAL EQUIPMENT

A new development in the field of polyphase squirrel-cage motors was the production of the one-piece centrifugally cast Copperspun rotor announced by Fairbanks, Morse & Co., Chicago. High electrical conductivity, low thermal expansion, high mechanical strength and the ability to assure dynamic balance are features claimed for the construction. The windings and end rings are cast in one piece by pouring molten copper into a revolving mold which encases the pressure-stacked laminations.







(1) General Electric manually operated air circuit breaker with special explosion-proof case. (2) Adjustable speed a.c. drive built by Westinghouse. (3) Group of General Electric Tri-Clad induction motors. (4) Inclosed Westinghouse non-automatic De-ion breaker for use in wet and dusty atmospheres

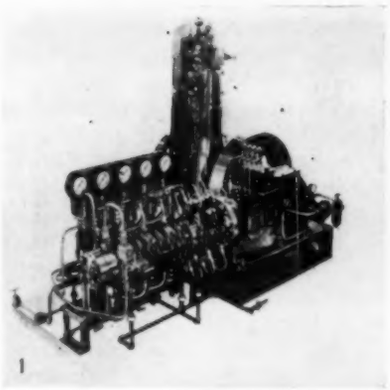
One of the most significant developments announced by the General Electric Co., during the period since the last Chemical Exposition, was its line of Tri-Clad electric motors. This complete series involves an extremely extensive product change. The streamlined cast iron frames have been designed to give more complete protection than hitherto available, except in specially inclosed models. Improved bearing design and lubrication arrangements and a new type of insulation are other features. Motors of a given size can be made considerably smaller than heretofore. The Tri-Clad construction has become available in a variety of special types, in addition to regular polyphase induction motors.

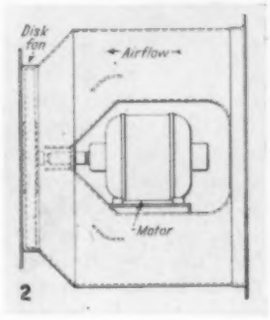
This company introduced new speed-variator equipment operating from an alternating current source to provide a wide range of adjustable speeds by means of the well known generator-voltage-control scheme. Each unit consists of an adjustable-speed, direct-current motor, an adjustable-voltage motor-generator set with control, and a separately mounted generator field rheostat.

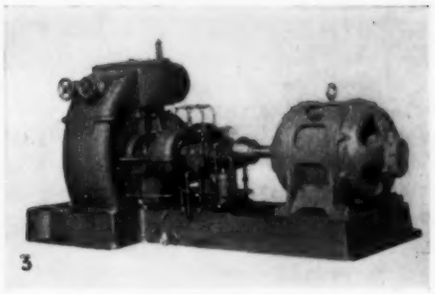
Other General Electric developments took place in the field of motor control. Included in this group was a new line of one- and two-button standard-duty pushbutton stations, the buttons of which are protected from accidental operation by guard rings. A line of non-corrodable, low-voltage, oil-immersed starters for process industries use was announced, with types for hazardous-gas locations. Also introduced was a line of 2,300-volt starters, comprising an oil-immersed contactor and a new type of current limiting fuse for short circuit protection.

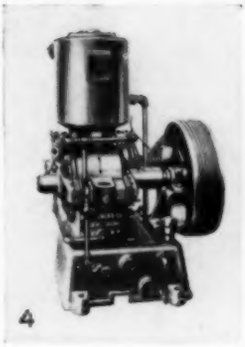
Other G. E. announcements in the field of control included an air circuit breaker for use in hazardous locations, mounted in an explosion-proof box. This breaker is rated at 25,000 amp. interrupting capacity, for continuous current up to 600 amp. at 600 volts a.c. Also for use in hazardous locations, where corrosive vapors are present, the company introduced a line of metal-clad switchgear for ratings up to and including 15,000 volts. The circuit breaker is of the oil-immersed type and the secondary control devices are mounted within each inclosure in a separate explosion-proof box.

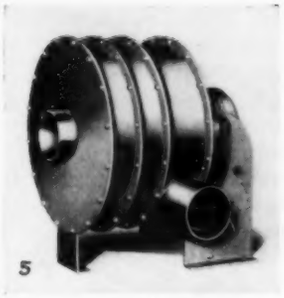
Improvements in various sorts of resistance equipment were brought out by Ohmite Mfg. Co., Chicago. These included glass-inclosed precision resistors for use in instruments











(1) Five-stage 15,000 lb. Clark Bros. compressor. (2) DeBothezat large-inlet Bifurcator duct-type fan (3) Roots-Connersville dual blower for three different air deliveries. (4) Beach-Russ RP high vacuum pump. (5) Ingersoll-Rand three-stage type G Motor-blower

subjected to moist or corrosive atmospheric conditions; 360-deg. continuous-wound rheostats for remote indicating systems for valves, dampers and other equipment; vitreous-enameled rheostats for generator field control; improved ceramic tap switches for ratings from 10 to 100 amp. a.c., and similar devices.

Numerous advances in electrical equipment have been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., within the last two years. A few of these can be mentioned here. The company developed a new magnet steel known as Hipersil, having a flux-carrying capacity about one-third greater than that of ordinary silicon steel, thus permitting the manufacture of transformers which are as much as 25 percent smaller and lighter than conventional units for the same capacity.

Also introduced were new devices for electrical control, such as an oil-immersed lighting panelboard for use in corrosive and explosive atmospheres. This unit employs thermal-strip branch circuit breakers for the protection of lighting circuits in locations either hazardous or corrosive. A compensating bi-metal corrects for the ambient temperature. A new general purpose Multi-Breaker to replace fuses or fused switches employs a bi-metallic thermal element which trips immediately on short circuit or dangerous overload, but has an inverse-time characteristic that allows it to remain closed during temporary, harmless overloads. For disconnecting or interrupting circuits in outdoor, damp, wet and dusty locations, the company announced a new non-automatic inclosed De-ion circuit interrupter in current ranges from 60 to 600 amp. at 250-600 volts, with a high interrupting capacity of 5,000-10,000 amp. Another new De-ion control is an inclosed circuit breaker for ratings from 15 to 600 amp., 250–600 volt, encased in a water- and dust-tight sheet steel case and available in types approved for Class I, Group D and Class II, Group G hazardous locations.

Among new motor developments of Westinghouse may be mentioned a group of fractional horsepower capacitor-start motors designed to permit instantaneous reversal. Another motor improvement is an a.c. drive designed to permit a 10 to 1 range of speed adjustment at constant torque. The arrangement is available in ratings from 1 to 15 hp. As compared with the usual system of accomplishing variable speed drive from an a.c. power source by all-electric means, the new system has been considerably simplified. The drive comprises a single-unit motor generator set, a d.c. series motor coupled to the driven load, a rheostat, an across-the-line starter for the motor generator, and a push-button station. An exceptionally flat torque characteristic is claimed.

FANS AND COMPRESSORS

Continued improvement in its line of rotary-piston high-vacuum pumps has been noted by the Beach-Russ Co., New York. For example the discharge valve has been redesigned by employment of spring-loaded disks in series, rather than the previously used poppet type.

Clark Bros. Co., Olean, N. Y., announced a new horizontal compressor for air or gas for pressures up to 15,000 lb. per sq. in. The compressor utilizes five stages and may be driven by any suitable means, for example, with a steam engine.

Among the developments of the DeBothezat Ventilating Equipment Division of American Machine & Metals, Inc., East Moline, Ill., were a power-operated roof ventilator and a large-inlet model of this company's straight-through-flow duct-mounted fan, the Bifurcator. The new Bifurcator employs an efficient axial flow fan with a non-overloading power characteristic mounted in a split section of duct with the motor in the split. This is installed as an integral part of the duct without directional change of the air flow. The roof ventilator, known as the Power-Flow, has the advantage of being low in height, compact, and consistent with modern architectural trends. The top of the ventilator, serving as a weather shield, tilts up and locks in raised position for easy access to the motor, fan and shutters.

For air supply for industrial processes at pressures from ½ to 2½ lb., and in volumes from 100 to 4,500 c.f.m., Ingersoll-Rand Co., New York, N. Y., developed an improved "Motorblower" of compact design. The performance characteristic causes power consumption to vary approximately in proportion to the volume of air delivered.

Several innovations in rotary compressors and vacuum pumps, and in new arrangements of previously developed equipment, were noted by the Roots-Connorsville Blower Corp., Connersville, Ind. One of these is a dual blower which with a constant speed motor, can be used to deliver three different volumes of air, the power consumption being almost in proportion to the air delivery. Such blowers are employed for agitating liquids where variable agitating effect is desired. Another development is

a compound unit with an intercooler, designed for pressures up to 20 lb. in smaller units and 25 lb. in larger units. A similar arrangement is also desirable for use in vacuum service above 18 in. Hg. A new check valve for air and gas handling was designed having a counterweight outside the valve, adjustable for very slight differences in pressure and to permit the valve to be used in any position without tending to hold open.

FEEDERS AND WEIGHERS

A new belt conveyor-weigher was developed by Fairbanks, Morse & Co., Chicago. So new that illustrations are not yet available, the weigher will be shown for the first time at the Chemical Exposition.

An extension of the usefulness of its well-known Constant-Weight Feeder was accomplished by the Hardinge Co., York, Pa. This feeder is of the type employing a balanced feed belt to adjust a gate leading from the feed hopper, so that a constant weight of material is delivered from the belt at all times. The new features relate to weight indicating and recording and when these features are used the equipment is known as the weight-recording Feedometer. It is now possible to secure with this equipment any or all of these following features: visual feed-rate indicator; totalizer recording cumulative weight fed (with reset recorder for totalizing batch or partial runs); printing attachment for printing cumulative weight; chart recorder for the control room; remote control of feed rate; interlocking of two or more feeders for proportioning; no-load cut-off and signal; etc.

Two new models of heavy-duty electromagnetic vibratory feeder-conveyors were introduced by the Syntron Co., Homer City, Pa. One has a capacity up to 100 tons per hour of material such as crushed rock, when employing a feeder pan as wide as 36 in. and as long as 60 in. The other is stated to handle as much as 500 tons per hour with a trough as wide as 48 in. and from 60 to 96 in. in length. This company also developed a water-powered hydraulic jolter to assist in compacting light powdery materials being packaged in drums and barrels. The hydraulically operated cylinder work on any source of water pressure above 50 lb. per sq. in.

A new version of its Printweigh device was developed by Toledo Scale Co., Toledo, Ohio. The new equipment is an integral part of the scale and is designed to provide quick, accurate printed records of weighed loads. It can be adjusted to print various sorts of tickets or strips and the control button may be located either at the scale or at a distance (or actuated automatically).

FILTERS

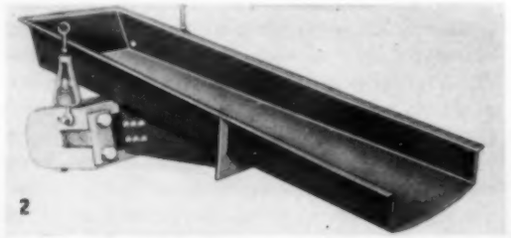
What is known as the F-M free flow filter plate is an improved type of plate for filter presses offered by Filter Media Corp., Irvington-on-Hudson, N. Y. Features of the plate include tapered drainage channels, broad lands or surfaces for the cloth support, direct connection between the channels and drainage manifold, a full capacity outlet, and direct connection between the wash water manifold and the drainage channel to provide faster and better washing. This plate can be made in several different woods or molded from a phenol formaldehyde compound. In a recent improvement, the strength of the plate section through the manifolds has been increased by staggering both the wash water manifold of the washing type and the discharge manifold of both.

An interesting improvement in filter-cake washing is evident in the application of the Oliver wash net to drum filter washing operations. The process is licensed by Oliver-United Filters, New York, under patents of Mid-Continent Petroleum Corp. and the National Lead Co. The wash net consists of a medium-mesh woven material resting on the rising side of the drum and kept spread out by the rotational movement. Wash water, rolling down the side, fills the little pockets in the mesh and sets up a cascading action which is said to result in uniform washing. The net helps to prevent cracks in the cake.

This company also designed a new black-liquor pulp washer and decker, known as the Oliver ring-valve washer. The valve consists of an annular ring encircling the inside of the drum, in line with outlets from each filter section. Each outlet in turn has two ports in the valve, one leading, the other trailing, which allows the liquor to enter the drum, from which it is discharged through one large trunnion. For washing, a special valve arrangement inside the drum is used to divert the flow of wash water away from the drum and through a hopper discharging to the other trunnion.

High flow rates, chemical inertness, resistance to heat shock and the ability to be cleaned by ignition are important characteristics claimed for a new and complete line of ceramic filters for all uses, ranging from laboratory to industrial work, that has been introduced by The Selas Co., Philadelphia. Included in the line are filter crucibles, filter candles, plates, cylinders and disks. Suggested applications include oil and acid filtrations, with or without a filter aid, as well as high temperature gas filtering.

(1) New model Toledo Printweigh scale. (2) Synton high-capacity vibrating feeder. (3) Hardinge weight-integrating feeder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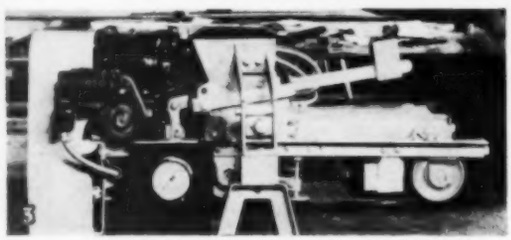
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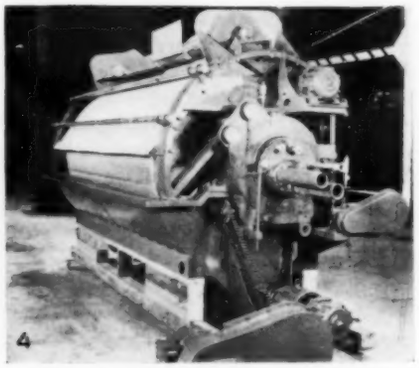
(4) Oliver continuous rotary starch filter equipped with wash net to accomplish uniform washing and prevent cracks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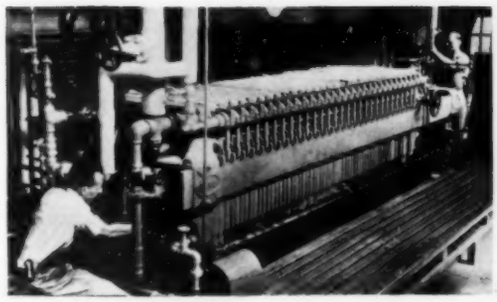
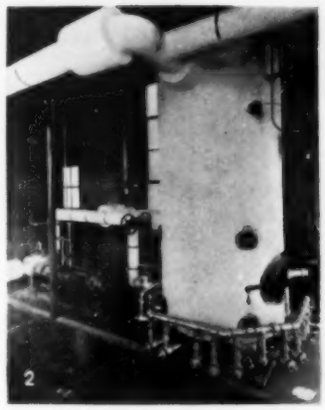
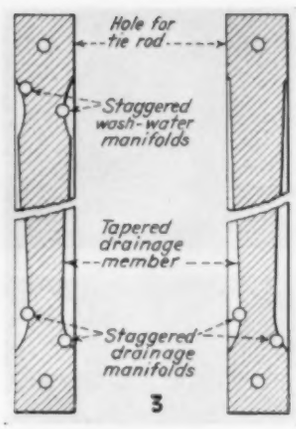
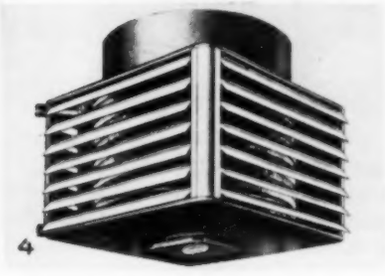








(1) Shriver jacketed filter press for filtration, solvent evaporation and re-dissolving of cake. (2) Eclipse Dowtherm heater and circulating pump. (3) Improved Filter Media Free-Flow filter plate. (4) Carrier five-way unit heater

T. Shriver & Co., Harrison, N. J., developed a plate-and-frame type thickener, similar in appearance to a filter press. Functions of the new unit include continuous thickening, washing and leaching. It is claimed that the elimination of settling rate as a factor in thickening gives greater speed, permitting the use of equipment of greater compactness and lower first cost. The company also announced a filter press with plates and frames made of molded phenolic resins, laminated cotton and asbestos fabric. Plates and frames of this type are reported to substitute satisfactorily for some of the more difficultly obtainable metals and to offer greater resistance to corrosion and contamination than do metal plates and frames.

A novelty in filter press operation devolved by this company eliminated a complex series of operations in several pieces of equipment. A unit was recently installed in which the cake from an organic slurry is filtered and washed. The remaining traces of solvent are then vaporized from the filter press by steam-heating the jacketed plates, the vapor being condensed in a separate condenser. Finally, hot water is pumped into the filter, dissolving the cake and permitting a clear, filtered solution of the desired concentration to be withdrawn.

Sparkler Manufacturing Co., Mundelein, Ill., is now sponsoring a simple renewable-cartridge filter for the purification of drinking water. A vertical cylinder with piping connections at the bottom has a removable cover at the top through which the cartridge is replaced. It is claimed that most water-borne impurities cannot be removed by backwashing or scrubbing, so an inexpensive replacement filter cartridge is used. Capacities range from 120 to 1,000 g.p.h.

HEAT EXCHANGE

A new unit heater of the suspended type for use in industrial and manufacturing buildings and designed for a variety of discharge arrangements was introduced by the Carrier Corp., Syracuse, N. Y. The cross-section of this unit is square and it is customarily equipped with adjustable louvers on two opposite sides and removable panels on the other two opposite sides. Additional louvered outlets can be installed if necessary. Units are available for steam pressures from 2 lb. to 100 lb., and also for hot water.

To eliminate difficulties with direct-firing, such as overheating and coking in the melting of materials of bituminous character, Eclipse Fuel Engineering Co., Rockford, Ill., developed a line of McKee Dowtherm liquid heaters which are gas-fired. The Dowtherm is heated to a temperature of about 450 deg. F., circulated through pipe coils at the bottom of the melting or dipping tank and back to the heater. Owing to the good heat transfer the temperature of the circulating medium is said to be seldom more than 40 deg. F. higher than the bituminous material being melted.

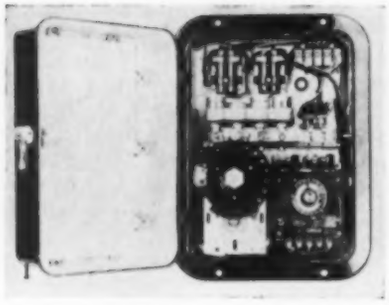
An improved type of steam heating surface for use in industrial plants was announced by the D. J. Murray Mfg. Co., Wausau, Wis. Known as the Grid condenser, this heating surface is of high-pressure finned type, capable of operating at pressures up to 250 lb. steam pressure. The unit is said to be immune to atmospheric corrosion and also electrolytic action, since the supply and return lines and steam chambers are all of the same type of metal. Each fin heating section is cast in one piece and the individual fin sections placed together to make up columns which are assembled, as many as needed, between supply and condensate headers.

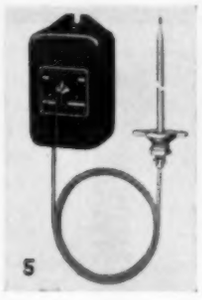
An interesting feature from the standpoint of maintenance is found in the Type E heat exchanger developed by the Patterson-Kelley Co., East Stroudsburg, Pa. This heat exchanger has Monel metal tube sheets and 250 sq.ft. of Admiralty metal tubing. The location of the feed and discharge pipes is such that the head may be removed for inspection or cleaning without disturbing any piping.

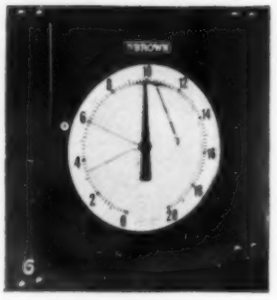
INSTRUMENTS AND CONTROL

Barber-Colman Co., Rockford, Ill., announced several temperature control devices, together with auxiliaries such as motor operators for valves and dampers, and motor-operated valves. This company's remote-bulb Microtherm is a thermostat of the liquid-filled type with hydraulically formed actuating bellows, built in two-position, floating and proportional control types. The proportioning type has a 9-deg. throttling range and electrical follow-up for throttling control. Also developed was a group of control motors of the high-torque, shaded-pole type, for regulating dampers and operating valves. The entire operating mechanism is completely submerged in oil and sealed in a die-cast case for complete protection.

For use in certain control applications employing transmitting potentiometers, the company has developed what is known as the Polarized







(1) Bristol timer for plastic molding presses. (2) Brabender Plastograph. (3) Industrial Instrument Solubridge controller. (4) Fabric Permeameter of Cambridge Instrument Co., for testing of coated fabrics. (5) Barber-Colman Microtherm controller. (6) Brown round-chart potentiometer pyrometer

Microrelay, a sensitive balanced type of relay. It may be used for the remote positioning of motor-operated valves and dampers and for remotely regulating speed changing devices.

This company has developed a building heating thermostat known as the Econostat, designed to control the heat supply in relation to outdoor temperatures, that is, in proportion to the heat loss from the entire structure. And for use in connection with its control instruments, the company has put out a series of motor-operated valves. One type, especially for chemical use, employs a Hills-McCanna Saunders patent valve of the diaphragm type. The other type, known as the sanitary valve, is also used in suitable metals of construction for a variety of chemical plant applications.

In addition to improving its semi-automatic moisture tester, its recording plasticity meter and its recorder for the combined effect of temperature and viscosity, Brabender Corp., Rochelle Park, N. J., is developing and expects to have ready for the Chemical Exposition a recording viscosimeter said to be the first of its kind. Heretofore, all simple viscosimeters are claimed to have been non-recording. The new instrument, worked out in cooperation with a large paint research laboratory, has been made adaptable to the investigation of all kinds of materials.

Among the new instruments announced by The Bristol Co., Waterbury, Conn., is a new strip-chart recorder with 6-in.-wide chart. Two new liquid-filled recording thermometers of the round-chart type have been announced, and several new instruments for timing. One is a time cycle controller for plastic molding presses, capable of timing automatically from one to four separate factors. Timing of the curing period is handled by an adjustable timer, while the other operations are timed by a cam carrying two cam segments which can be cut to proper length and positioned to give the desired schedule. The company's new multiple-cam controller was designed for use on tire molds and other plant processes where a number of factors require definite programming. Time measurement and pilot valve operation are handled by separate mechanisms. The cam mechanism can operate up to eight pilot valves.

An entirely new balancing device for its null-point potentiometer mechanism was developed by Brown Instrument Co., Philadelphia, Pa. This is used in a new circular-chart potentiometer pyrometer recently put on the market. The balancing system is continuous, has no galvanometer, and is said to be unique in speed of response and sensitivity to minute temperature changes. A brushless, reversible induction motor with built-in gear reduction is used for the balancing.

Cambridge Instrument Co., New York, introduced several new instruments. One of these was a pH recorder for recording simultaneously pH measurements from two or more glass electrodes. Recording from a single glass electrode has previously been possible but multiple recording is said not to have been feasible owing to inter-action between circuits and the unreliability of switching from one circuit to another. A new circuit was devised, together with means for complete electrical isolation of each measuring circuit. Another new development is a fabric permeameter for the testing of fabrics which must hold gas. The fabric is used as a separating membrane in a thermal conductivity cell, and is tested for leakage rate with hydrogen.

The company also developed two types of oxygen recorder, both working on the thermal conductivity principle. One type, used for measuring oxygen in flue gases, employs a thermal conductivity bridge in which the flue gas sample in the original condition passes through one side of the bridge, then through a small furnace containing a heated carbon rod where the oxygen in the sample combines with the carbon to form an equal volume of carbon dioxide. The sample with the oxygen replaced by CO_2 then flows through the other side of the bridge and the unbalance is indicative of, and recorded as, oxygen in the original flue gas. A somewhat similar principle is used in an extremely accurate instrument for the measurement of dissolved oxygen in boiler feed water. The water to be analyzed is scrubbed with hydrogen from a small electrolytic cell and the mixed hydrogen and displaced oxygen discharging from the scrubber are analyzed in a thermal conductivity cell block in comparison with pure saturated hydrogen.

Among a variety of new instruments that were produced by Fischer & Porter Co., Hatboro, Pa., is the new Ultra-Stabl-Vis rotameter which the manufacturer claims is unaffected by varying viscosity of the liquid being measured. In earlier types of rotameter flowmeters, the effect of in-

creasing viscosity was to indicate a flow rate higher than actual. Recent experiments conducted by the company have developed the ability to produce a type of rotameter float which actually shows lower apparent flow with increasing viscosity. Thus it is said to be possible to strike between these two extremes and produce a float with zero correction. The display contemplated for the Chemical Exposition will show this effectively by demonstrating the errors of the old float when operated on high and low viscosity liquids, while the new float will be shown to give the same reading for both types of liquid. Another new type of rotameter is an air-operated automatic flow controller, with electrical transmission from the rotameter to the control instrument. This controller has throttling range adjustment from zero to 150 percent and adjustable drift compensation.

Several improvements in pressure regulating equipment were announced by Fisher Governor Co., Marshalltown, Ia. A new pilot-operated pressure reducing valve for steam service, designated as Type 92, was designed for extremely accurate regulation in globe body sizes from ½ to 6 in. An improvement for use with diaphragm motor valves is the company's new Wizard pressure pilot, designed to give added sensitivity in pressure and flow control. This pilot is built in both direct-mounted types for integral attachment to the diaphragm casing, and in remote mounted types for installation on panelboards. All types have adjustments for changing the throttling range and the pressure setting.

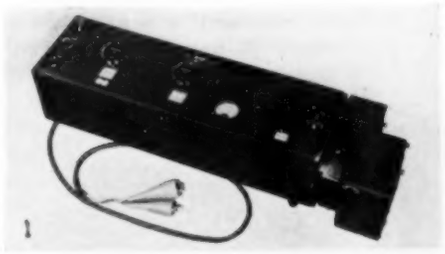
Since introducing the Stabilog controller several years ago, Foxboro Co., Foxboro, Mass., has found little to change in the original design. The new Model 30, just introduced, is modified only to the extent of design refinements. Improved appearance is one factor, with a dual pressure gage indicator replacing the customary two small gages. All operating adjustments are made from the front of the case and are immediately accessible when the door is open. Unit construction simplifies replacement of the measuring system, changes in the type of control, or any other major servicing that may be necessary.

A rangeability of 50 to 1, coupled with the high lift characteristics necessary for wide-range flow control, and a considerably greater movement of the valve for the same air pressure change, are features of the improved Stabilflo diaphragm valve that was also announced by Foxboro.

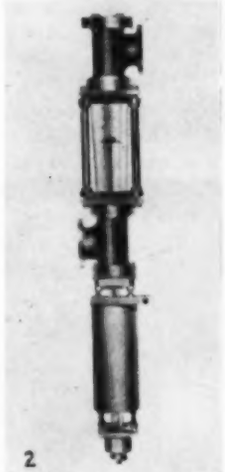
A simple device for storing hydraulic energy to operate various sorts of control devices is the Hycon, developed by Hydraulic Controls, Inc., Chicago. This is a miniature hydraulic accumulator, in which the hydraulic fluid is forced by a small pump into a high pressure storage tank, against the pressure of a confined gas. Thus by operating the pump for a considerable time during portions of the cycle when the working fluid is not being called upon to exert its energy, a relatively large amount of fluid is available at high pressure, in comparison with the pump capacity. This stored pressure may be used in any desired fashion to operate the power cylinders of large valves, as well as hoists, materials handling equipment of other sorts, doors, etc. After functioning in the cylinder, the fluid returns to a storage tank from which it is pumped back to the pressure tank for re-use.

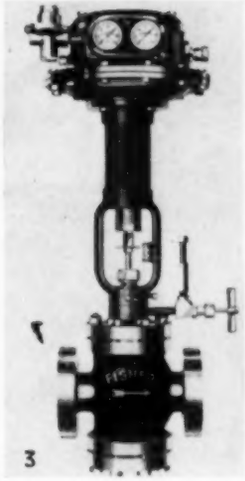
Several developments in electron-tube-operated instruments were brought out by Industrial Instruments, Inc., Jersey City, N. J. In the main, these instruments use the electrical conductivity of solutions as the measured variable. The fundamental instrument is the company's conductivity bridge which is essentially a wheatstone bridge of simplified design, for operation on alternating current, and employing a cathode-ray null indicator or "magic eye" instead of a galvanometer to indicate balance. Some form of conductivity cell for measuring the conductivity of a fixed cross section and length of the solution is employed. One version, known as the Solubridge, is provided with a dip cell, a temperature compensating dial and a potentiometer control dial. The Solubridge controller is similar except for the addition of a relay of the electronic type for operating a signal or warning light or controlling the operation of a valve.

In another instrument the company cooperated with Max Mosher, New York and St. Louis, in simplifying through the use of electronic devices the Mosher automatic control for grinding equipment feeders. Once the instrument has been set for the de-

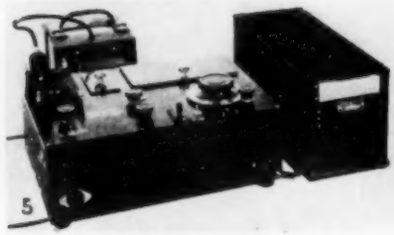


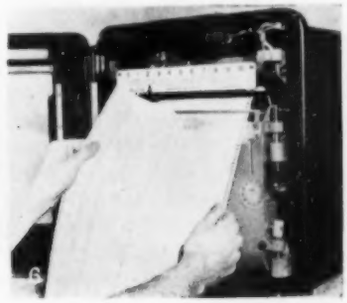
(1) Beckman spectrophotometer. (2) New Fischer & Porter heavy duty rotameter, used in conjunction with air-operated control





(3) Fisher Regulator's Wizard pressure pilot installed on diaphragm valve. (4) Foxboro Model 30 Stabilog. (5) Combination fluorescence meter made by Photovolt Corp. (6) New chart tear-off device of Leeds & Northrup





sired power consumption of the grinding equipment motor, should this load be exceeded, the controller will shut down the feed motor until the mill has cleared itself. The controller also flashes signal lights to indicate the condition of operation.

One of several developments announced by Leeds & Northrup Co., Philadelphia, was an improved chart tear-off for strip-chart recorders, which is made to fit all of this company's Micromax instruments built since 1936. Similar in use, but somewhat different in principle was the C. J. Tagliabue Mfg. Co.'s tear-off device. This company, at its Brooklyn, N. Y. plant, has developed a type comprising a tear-off bar and a re-roll with clip and tape. The clip, of a special design without springs, firmly grips the chart after a chart section has been removed. Such devices make it easy to file daily strip-chart records.

Several recent instrument developments have come out of the plant of National Technical Laboratories, South Pasadena, Calif. One of these was the Beckman high-temperature glass electrode, for pH measurements on solutions at temperatures as high as 100 deg. C. Reliable measurements at such temperatures are said to have been impossible in the past with the glass electrode. Production of the Beckman high pH electrode is another new development which is claimed to have solved a similar difficulty in the case of highly alkaline solutions above pH 10, in the presence of sodium ion. An entirely new type of glass electrode was worked out which requires no sodium-ion correction until well above pH 11.

Another improvement brought out by this company in connection with glass electrode pH measurement is a new automatic multiple glass electrode switch, which has just been announced. This switch makes possible automatic continuous pH recording from as many as six different glass electrode stations with only one pH indicator and one multiple recording instrument. The switch automatically connects each electrode station in turn to the instrument.

An interesting photoelectric spectrophotometer introduced by the company was designed to be completely self-contained and to utilize an electronic circuit for rapid measurement of percent transmission and density. The instrument can employ wave lengths between 200 millimicrons and 2,000. It can use various types of light source and is adaptable to control work as well as research.

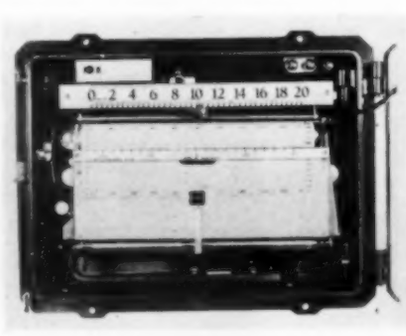
As an addition to its line of photoelectric colorimeters, the Photovolt Corp., New York, developed a combination fluorescence meter and colorimeter, designated as Model 402EF. Primarily intended for the determination of vitamins B_1 and B_2, A and D, the meter may also be used in measurements of transmission, turbidity, ultra-violet absorption and reflection. It normally makes use of a mercury vapor light source, but can equally well employ an incandescent lamp for such determinations as transmission. The optical system condenses the light from the source to a parallel beam, part of which is reflected at right angles on to a balance photocell, while the remainder enters the sample holder, either exciting a pair of fluorescence photocells placed at either side or, in the case of transmission measurements, passing through to a transmission photocell. The cell output is balanced against the balance photocell by means of a potentiometer.

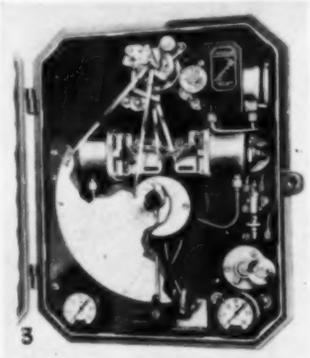
New slide comparators for boiler water testing have been developed by W. A. Taylor & Co., Baltimore. Designed for controlling pH and phosphate content of boiler water to minimize corrosion and scale formation, these units come in a low-phosphate comparator for 0-25 p.p.m. as PO_4, and a high phosphate comparator for 5-100 p.p.m. The complete boiler water comparator consists of either type of phosphate comparator, three pH color standard slides and the necessary pH indicator solutions and reagents for both pH and phosphate determinations. It is stated that with the method used for phosphate testing, 10,000 p.p.m. of SiO_2, 100 p.p.m. of ferrous or ferric iron or 1,000 p.p.m. of sulphites will cause no error.

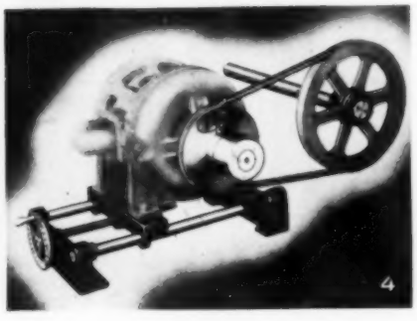
Developments in several directions were evident in new designs introduced by Taylor Instrument Cos., Rochester, N. Y. For applications where temperature, pressure, flow rate or some other variable must be controlled in a desired ratio to another related variable, the company introduced a direct-setting ratio controller, the ratio of which can be changed by a simple screw-driver adjustment anywhere in the range from 0 to 1, to 3 to 1, direct or inverse. Another new instrument is a remote pneumatic transmitter for reproducing the indications of various variables at a remote point.

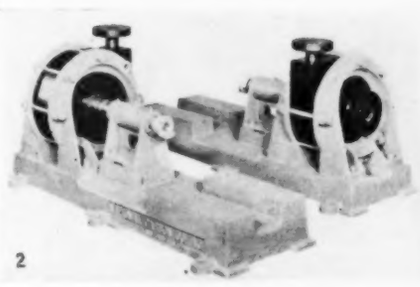
Two improvements were concerned with timing equipment. The company's new Flex-O-Timer eliminates the need for cam cutting by use of adjustable pins on a revolving drum, which operate either air valves or switches, as required. A new type low-leak air valve designed for this timer is said to utilize 99½ percent of the air passing through it. However, many timing operations are considerably simpler. For instance, in batch operations it is sometimes necessary to control the duration of the process.

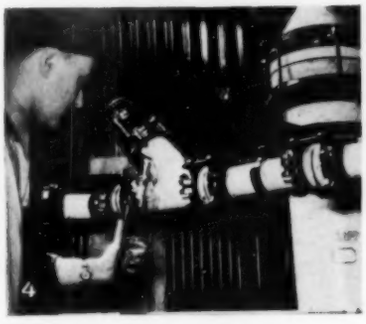
(1) Tagliabue chart-tear-off device. (2) Taylor boiler water comparator. (3) Taylor Instrument Co.'s new ratio controller. (4) Reeves Vari-Speed Jr.











(1) Nash Engineering Co.'s small size Corning-Nash Pyrex centrifugal pump. (2) All carbon centrifugal pumps made by National Carbon Co. (3) Steel tank rubber-lined by Galigher Co. (4) Lapp chemical porcelain valve and pipe

A simple timing device now available does not start until the process has reached the set point of the controller. Then timing begins and at the end of the desired period, the timing mechanism automatically terminates the process.

LUBRICATION AND POWER TRANSMISSION

Among new developments brought out by the Farval Corp., Cleveland, is the Dualine Jr. centralized lubrication system for use on smaller machinery than the standard Dualine line. The new equipment operates on the same principle as this company's larger type but employs valves, pumping units, fittings and lines of greatly reduced size. A central pumping unit connected by two supply lines to a group of valves discharges lubricant from the individual valves to individual bearings. Either oil or grease may be used.

Two improved types of power transmission belting were announced by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. One, known as Condor whipcord endless belt, is made in two styles, a light weight belt in widths from 1 to 3 in. for light loads and high speeds, and a general purpose belt for most types of industrial service, in widths from 2 to 6 in. The endless-wound whipcord section is placed in the neutral-axis area of the belt and bonded in a matrix of heat-dissipating tie-gum which is completely surrounded with a flexible wear-resisting duck cover. Another new belt, known as the Paranite-G.O.P. oilproof and non-sparking whipcord endless belt, is similar in construction to the first except that this company's gas and oilproof synthetic rubber is used throughout, in place of natural rubber, making the belt especially suited for service in contact with oil or where there are fire and explosion hazards resulting from static.

Supplementing its line of variable speed transmissions, the Reeves Pulley Co., Columbus, Ind., developed the Vari-Speed Jr. for controlling the speed of light machinery operated by constant-speed motors from fractional to 1½ hp. This unit comprises a disk assembly and adjustable motor base, the disk consisting of two cone-shaped disks, one stationary and one adjustable, held together by a self-adjusting tension spring. The assembly is applied directly to the standard shaft extension of the motor and the motor is mounted on an adjustable base. The V-belt, driving between the two disks and the pulley of the driven machine, is caused to run on a larger or smaller diameter of the disk depending on the way the motor is positioned on its base by means of the handwheel.

MATERIALS OF CONSTRUCTION

Among new construction materials introduced for laboratory table tops was the grade 25 stone developed by Alberene Stone Corp. of Virginia, New York. This stone which is dark in color and of good appearance is claimed to be especially tough and abrasion-resisting as well as highly resistant to acids and alkalis, even at high temperature.

Precious metals as construction materials for process purposes have developed in a number of interesting directions. Baker & Co., Newark, N. J., mentions among others, the following: platinum-clad copper electrodes for perchlorate plants now building and projected; platinum-clad electric immersion heaters in both industrial and laboratory sizes; silver for condenser leaves and other electrical applications replacing aluminum; silver for various applications ordinarily handled with brass or copper in decorative and electrical applications (even for slip-rings and armature segments for small motors); and platinum-clad metal for replacing stainless steel and other nickel-bearing alloys in chemical equipment.

A case where necessity mothered the development of an advantageous substitution of a low-priced construction material for an expensive one has been described by Black-Sivalls & Bryson, Inc., Kansas City, Mo. In supplying insert flanges for supporting the safety heads made by this company, stainless steel has frequently been used where the service is corrosive. For low temperature applications at pressures not over 150 lb., the company has found that such insert flanges can frequently be molded from phenol-formaldehyde plastic or machined from a laminated plastic of the same type. The company notes that what was undertaken as an expedient turned out to be advantageous in certain cases, in that satisfactory service coupled with short delivery time is assured.

A variety of new glass parts for industrial use have been developed by Corning Glass Works, Corning, N. Y., to meet the demand for substitutes for non-procurable metals. In cooperation with Nash Engineering Co., South Norwalk, Conn., the company developed a new small size of Corning-Nash glass centrifugal pump, as a companion of the larger pump exhibited at the last Chemical Exposition. Other work, carried considerably beyond the stage of the material at the time of the last Exposition, was the production of new and sometimes intricate shapes of Vycor 96 percent silica glass which, although it is still made with pilot plant equipment and is still available only in rather limited quantities, can be produced in sizes, shapes and

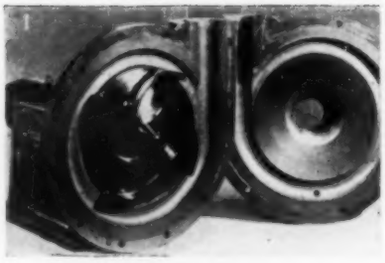
designs hitherto considered impractical of economical manufacture from glass. It will be recalled that this interesting product, which has substantially the same high melting point and low thermal expansion as fused silica, is produced by chemical treatment of glass, removing the bulk of the glass constituents other than silica. Then, by further heat treatment of the high-silica skeleton, the material is shrunk to about 65 percent of its original volume.

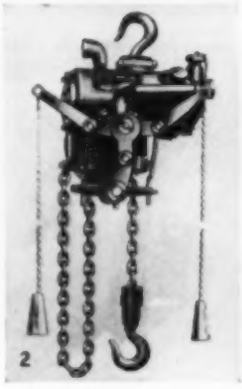
A new department for rubber vulcanizing service, particularly for the vulcanization of rubber to metals, has been established by the Galigher Co., Salt Lake City. The department is now set up to rubber-line steel tanks, manufacture rubber-lined pipe and pipe fittings, and do similar rubber covering for the protection of equipment against abrasion and corrosion.

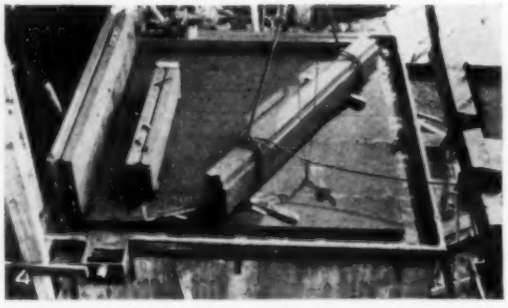
Several of its chemical stoneware bodies have been improved, while new bodies have been developed by General Ceramics Co., Keasbey, N. J. In the latter category is a stoneware body with a thermal conductivity three or four times that of the regular ware. This is accomplished by replacing siliceous material in the body by silicon carbide. Although the use of silicon carbide in ceramic bodies is not new, formerly it has been accompanied by a large increase in porosity of the ware. The new high thermal conductivity ware is said to have eliminated this disadvantage and to be almost as dense as the regular grade of stoneware. A new fine-grained porous ceramic ware for making electrolytic diaphragms is also being made. To avoid the necessity of making changes in cells and other accessory equipment, these diaphragms are made comparable in pore volume, pore size, electrical resistance, and other physical properties to those formerly imported. They are said to be of greater mechanical strength than the imported product.

A new product with this company is an impervious, corrosion-resisting, processed stone for laboratory table tops, known as Cerastone. This material is a selected natural Ohio sandstone which has been autoclaved under controlled conditions to render it completely non-porous. Slabs are available in sizes up to 8×4 ft.

Continued expansion of the line of chemical porcelainware introduced shortly before the last Chemical Exposition has been carried on by Lapp Insulator Co., LeRoy, N. Y. Many new items have been developed, including larger sized vessels, larger pipe and fittings and new methods of







(1) Olivite pump with Olivex parts. (2) Ingersoll-Rand Air-Bloc hoist. (3) Baker center-control fork truck. (4) Building an all-carbon Cottrell precipitator

making up joints. The company designed automatic equipment for producing tower packings and perfected an all-porcelain valve of the Y type, featuring a lapped joint between the porcelain plug and seat, and a porcelain lantern ring situated in the packing for draining off any leakage which might otherwise pass the packing and attack the exterior metal operating parts of the valve.

CARBON PARTS

National Carbon Co., New York, reports that considerable progress has been made in the application of carbon and graphite products for equipment construction since the last Chemical Exposition. Further development work on impervious carbon and graphite (Karbate) has broadened the usefulness of these materials, making pipe, fittings, valves, bubble caps, trays, grilles, tanks, towers and other structural parts available in a variety of sizes. Extensive use of Karbate materials in heat exchanger and condenser construction has been noted. In addition to simple types such as bayonet and candle heaters, more complicated exchangers such as shell and tube floating types have been made, with headers, baffles, flanges and other parts constructed of Karbate. One application of Karbate was in valves of the Saunders diaphragm type. The material has been used in construction of a variety of towers up to 48 in. diameter, and for tanks both large and small. A new application of Karbate is for centrifugal pumps, which have rotary shaft seals made of this material. Four sizes are available up to 100 g.p.m. at 100 ft. heads.

Similar progress is also reported for the porous type of carbon and graphite materials. Further development of the use of carbon in the manufacture of Cottrell precipitators has also been noted. One all-carbon Cottrell was built, having a size of 14×14 ft. and 27 ft. high. A still larger one with 117 tubes was constructed. The use of large carbon beams and slabs instead of brick of ordinary size in these precipitators has resulted in great savings in construction time as compared with brick of normal size. For example, in the view shown, each large side-wall section was equivalent to approximately 1,000 brick.

Protective Coatings, Inc., Detroit, announced many new coating materials for industrial protection. This concern, formerly known as Paramount Rubber Service, now has four lines of products, all of which have been brought out within the last few years. The company's rubber division produces dipped, sprayed and seamless rubber coatings of soft, hard and synthetic rubber, as well as molded rubber parts. The synthetic division handles a group of synthetic coatings for wood, metals, etc., for decoration and protection against acid as well as atmospheric corrosion. The specialty division lists waterproofings, rust inhibiting primers, metal conditioners, metal cleaners,

preservatives for rubber and paper, heat resisting paints, masonry finishes and waterproofers, and special concrete and masonry floor paints. In the line of the industrial coatings division are included chemical resisting coatings and caulking materials, for metals and other surfaces, as well as damp-proofing for masonry.

A large number of new developments in coating and luting materials, as well as in chemical stoneware, have been announced by U.S. Stoneware Co., Akron. In the former classification is the company's new Tygon corrosion-resisting paint, based on a modified halide polymer and said to be adapted for general resistance to corrosive attack from all corrosive agents. The material is recommended by the manufacturer for protection of wood, concrete and steel. Another new corrosion-resistant paint is an air-drying product based on Vinylite. The company has developed a self-hardening synthetic resin cement for resistance against acids, alkalis and solvents to 350 deg. F. A new plastic chemical putty for joint making is another product, and a rubber-cement material in calendered sheets for packing the joints of bell-and-spigot pipes. Performance of this company's lining materials of synthetic and rubber-like character is said to have been improved in various particulars. New methods for securing better adhesion have been worked out. For example, the Tygon corrosion-resistant lining is now being employed in protecting fans with steel rotors and cast iron housings, to replace special alloy construction materials.

This company also has introduced several recent improvements in chemical stoneware. A new line of chemical stoneware gate valves in sizes from 1 to 4 in. may be mentioned, new sizes of stoneware raschig rings, and a new zero-sorption white porcelain raschig ring. The company plans to exhibit a new streamlined tower packing developed by Andrew M. Fairlie, for which numerous advantages are claimed. Since acquisition of the plant of the Federal Refractories Corp. at Mineral City, Ohio, U. S. Stoneware has also gone into the manufacture of a new grade of low-porosity acidproof brick and a complete line of firebrick shapes and refractory cements. Ceratherm, a new stoneware body developed by the company, has been designed specifically for conditions involving high heat and rapid changes in temperature.

MATERIALS HANDLING

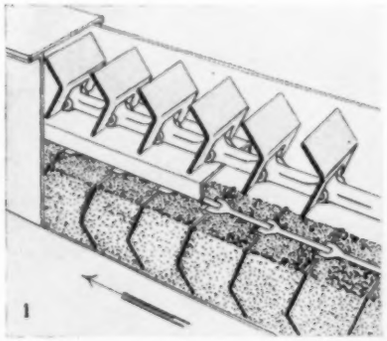
Among the new industrial trucks introduced by the Baker Industrial Truck Division of the Baker-Raulang Co., Cleveland, was a compact center-control fork truck made in two models for 2,000 and 3,000 lb. capacities. With the standard simple lift, lifting height is 72 in., and 119 in. with the telescoping lift. An electrical safety contactor interlocked with the controller and the operator's seat automatically prevents operation when the operator leaves the machine. Ability to work in narrow aisles and congested areas is an important feature. Another new truck known as the Hy-Lift has a capacity of 4,000 lb. Lifting is accomplished by a hydraulic system consisting of a gear pump driven by a separate motor. The standard simple lift is 60 in., and the telescoping lift, 119 in.

Ingersoll-Rand Co., New York, is now building a series of air-operated hoists for light loads, up to 700 lb. in the largest size, and 300 and 500 lb. in the smaller sizes. The hoist is extremely light in weight and features a limit control and a safety feature which prevents the load from dropping if the air supply should fail.

Several new types of equipment employing electrically produced vibration to effect material movement were developed or perfected by the Jeffrey Mfg. Co., Columbus, Ohio. Among these was a water-sprayed cooler for plastics, comprising a covered trough-like vessel mounted on vibrators and provided with an inclosed spray system and drip pan. Also for materials handling, but operated on a different system was the Mass-Flo elevator-conveyor introduced during this period. This conveyor employs a continuous chain with attached flights, operating in an inclosed duct for moving material horizontally, vertically or at any desired angle. Conveyors of this type are self-feeding, self-cleaning and can operate at partial loads.

Another concern active in developing improved types of materials handling equipment was the Lewis-Shepard Sales Corp., Watertown, Mass. One type is a drum-dumping stacker for lifting a drum or barrel of either dry or liquid material high enough for dumping over the side of a tank, yet permitting control by the operator from the floor level. A later improvement in this connection is a toggle-type drum dumping harness for supporting the drum on the dumping stacker in the simplest possible fashion. A spring toggle attaches the drum to the harness without the necessity for adjustment or tightening of straps. Another development applies to hinged portable elevators, for which types of equipment the company has developed spring counterbalances for the hinged portion, to permit easy raising and lowering and thus to eliminate any possible danger in this operation.

Several interesting improvements in materials handling equipment



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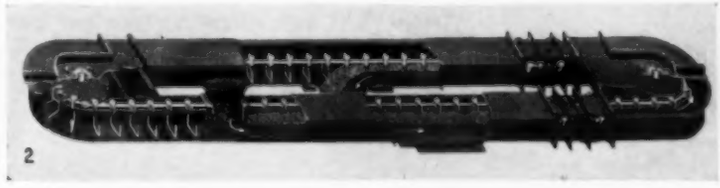

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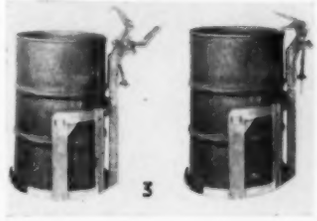

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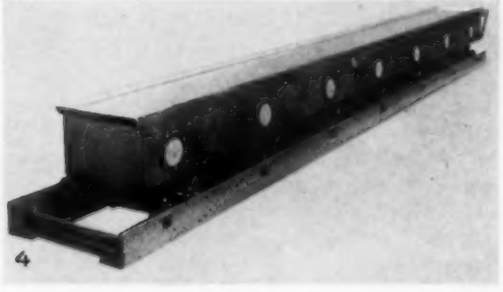

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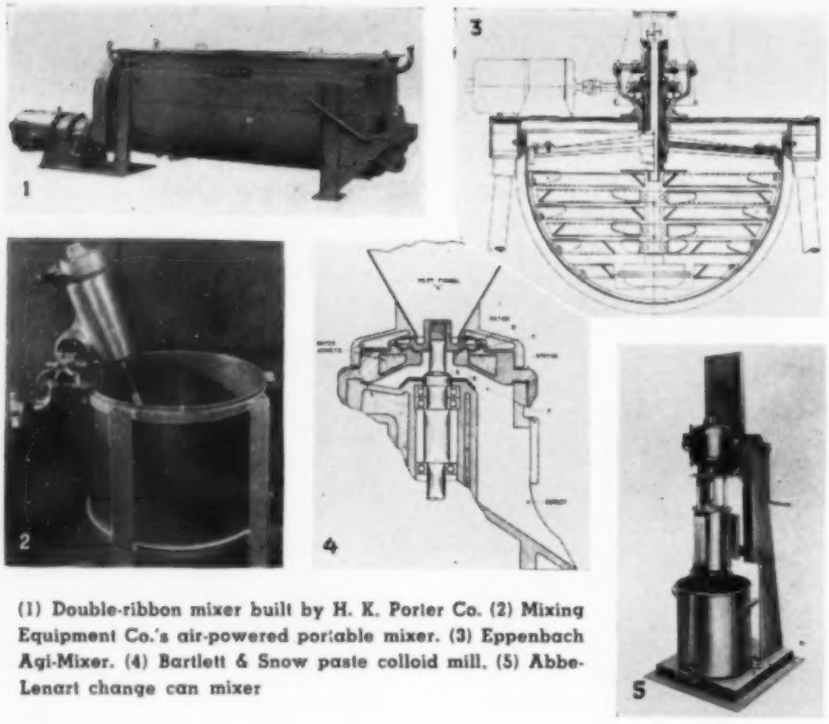
(1) Link-Belt Co.'s new self-cleaning Bulk-Flo conveyor. (2) New horizontal Stephens-Adamson Redler conveyor with drive in separate compartment

(3) Lewis-Shepard toggle-type barrel and drum harness for quick attachment to tilting stackers. (4) Jeffrey-Traylor water-sprayed vibrating cooler



(1) Double-ribbon mixer built by H. K. Porter Co. (2) Mixing Equipment Co.'s air-powered portable mixer. (3) Eppenbach Agi-Mixer. (4) Bartlett & Snow paste colloid mill. (5) Abbe-Lenart change can mixer

came from the Link-Belt Co., Chicago. The Bulk-Flo conveyor was one of these. The conveying medium consists of a specially designed chain, usually made of malleable iron, to which solid peak-top flights are rigidly attached at every pitch. They divide the material in the closed conveyor duct into a continuous series of batches which are moved positively by the peak-top flights, whether the load is full or only partial. This conveyor can follow almost any desired path, and may be loaded or unloaded at various points to suit conditions. Compactness, self-feeding, self-cleaning and non-overloading characteristics are important features.

This company also introduced several belt conveyor improvements. One is a swiveling, positive, self-aligning idler for automatically correcting misalignment of belts. It can be used on either the carrying or return runs of non-reversing belt conveyors, supported on flat-roll idlers. A special idler supported on a centrally pivoted cross member has vertically mounted actuating rolls at each end. Light pressure against either roll swivels the idler unit and guides the belt back to proper alignment. A line of rubber-tread idlers for supporting the flat return run of belt conveyors was also announced, and a rubber-tread troughing belt idler, for the carrying run of belt for use under feed points.

A new type of horizontal, closed-circuit Redler conveyor, with the driving chain moving in a compartment separate from the compartment handling the conveyed material, was one of the improvements introduced by Stephens-Adamson Mfg. Co., Aurora, Ill. This construction is said to eliminate any metal-to-metal contact in the carrying run of the conveyor, preventing any possible contamination of the conveyed material, by metal, dirt or lubricant.

MIXING

One of the latest variations of the Abbe-Lenart Mixer, built by the Abbe Engineering Co., New York, was introduced during the period under discussion. This is a change-can mixer, the mixing element of which is mounted on an elevating device to permit withdrawing it from the can used for processing the batch. This mixer is intended particularly for handling sensitive materials which must remain in special containers, or those hard to transfer.

A manufacturer who entered the colloid mill field recently was C. O. Bartlett & Snow Co., Cleveland. This concern introduced its new Triple Action colloid mill early in 1941. Earlier designs were intended for the more fluid mixtures. A recent modification is a mill for pastes and semi-solids. One of the novel features of these mills is the versatility of types of rotor that may be employed. Another is the fact that the principal shearing action of the mill takes place as the material is forced from the periphery of the rotor toward the center, rather than the customary reverse action. These mills feed from a hopper at the center of the top of a horizontal rotor revolving (in the smaller sized mills) at 10,800 r.p.m. The top rotor surface carries an impeller *B* which forces the material down through the peripheral gap and inward between the stator and lower surface of the rotor. Depending on requirements, the gap between these last mentioned surfaces may be any one of several different designs. Circumferential grooves may be used, either plain or cut in teeth, or the surfaces may be plain. The new paste mill, illustrated herewith, employs a rotor form which results in crowding the material into constantly smaller areas as it approaches the center of the rotor. This it reaches after traversing the first and second stage surfaces, *C* and *D*, and the third stage plain surface, *E*.

Novel in design, a new type of double-motion mixer offered by Eppenbach, Inc., Long Island City, N. Y., is known as the Agi-Mixer and combines the turbine feature of this company's Homo-Mixer with a paddle and scraper arrangement. The purpose of this design is to give continuous mixing throughout various viscosity phases, as in the saponification of fatty acids. The turbine-type mixer which is centrally located near the bottom of the mixing vessel is used to start the operation; but when the mixture becomes viscous, the paddle and scraper arrangement is started. The mixer employs two drives. The outer tubular shaft supports and operates the movable paddles which are carried on a horseshoe-shaped element running close to the container. The intermediate tubular shaft supports the Homo-Mixer stator and also a group of stationary paddles between which the movable paddles run. The inner solid shaft, driven by the second drive, drives the rotor of the Homo-Mixer.

To improve dry mixing operations, Hendrick Mfg. Co., Carbondale, Pa., has designed two new types of conical tumbler blenders. When thorough cleaning of the blender after each run is needed, the tumbler uses trunnions instead of a through shaft and buffed internal welds to facilitate removing all material. The second type, used where cleaning is not so important, employs a through shaft support for the double-cone drum which supports an internal grating over half the interior, this grating impeding the fall of half the material during rotation of the blender and thus developing a weaving motion which is said to save as much as 40 percent of the blending time in some cases, as compared with blenders not using this internal baffle.

New types of mixers now made by Mixing Equipment Co., Rochester, N. Y., are in several cases aimed at better or safer defense production. For example, the company has developed a portable mixer with air-driven motor to meet safety requirements in explosives manufacturing. This mixer has a turbine-type air motor with built-in muffler and speed control, and a simplified housing for ready cleaning. The company reports that when the air supply is already available, an air-powered mixer is considerably less expensive than an electric powered mixer with explosion-proof motor. However, operating cost is lower for the electric mixer and may, in fact, be much lower. Among other new designs were turbine-type agitators in a variety of constructions for defense industries, such as the manufacture of mixed acids and synthetic rubber.

H. K. Porter Co., Pittsburgh, introduced several new equipment designs among which was a jacketed double-ribbon mixing machine for materials ranging from dry powders to heavy, viscous pastes. Two metal ribbons on a shaft revolve close to the surface of a mixing cylinder so as to create a double-folding action on the material which is automatically worked toward the discharge end of the cylinder. Another type of mixer for paints employs a vertical container with a side discharge gate and a compact motor drive operating a finger-type stirrer running close to the sides and bottom of the mixing vessel. The company introduced a new agitator drive with a vertical motor and direct-connected planetary reduction gearing, available in sizes from ½ to 50 hp.

PACKAGING

An improvement in packaging equipment for the wire stitching of telescoping and folding cartons and set-up boxes is the line of Silverstitchers developed by Acme Steel Co., Chicago. The line includes three machines. The straight-arm type is for stitching sides and ends and the bottom type for stitching bottoms of fiber and corrugated containers. The third type, known as the combination Silverstitcher, combines features of both the straight arm and bottom types in one piece of equipment. These machines are said to incorporate a number of features unique in the field. A special single-pedal control is provided which is adjustable and is claimed to reduce by half the manual effort required for stitching. Parts subjected to wear are reversible to decrease maintenance costs.

One novel way of increasing capacity, without a commensurate increase in the amount of equipment required was worked out by New Jersey Machine Corp., Hoboken, for the benefit of some of its clients in the pharmaceutical industry. One company needed two machines, but delivery time would have been somewhat long. The solution was to double up on certain parts of this company's Pony Labelrite machine so as to make a single labeler handle two products at the same time, practically doubling the usefulness of the unit.

PUMPS AND PIPING

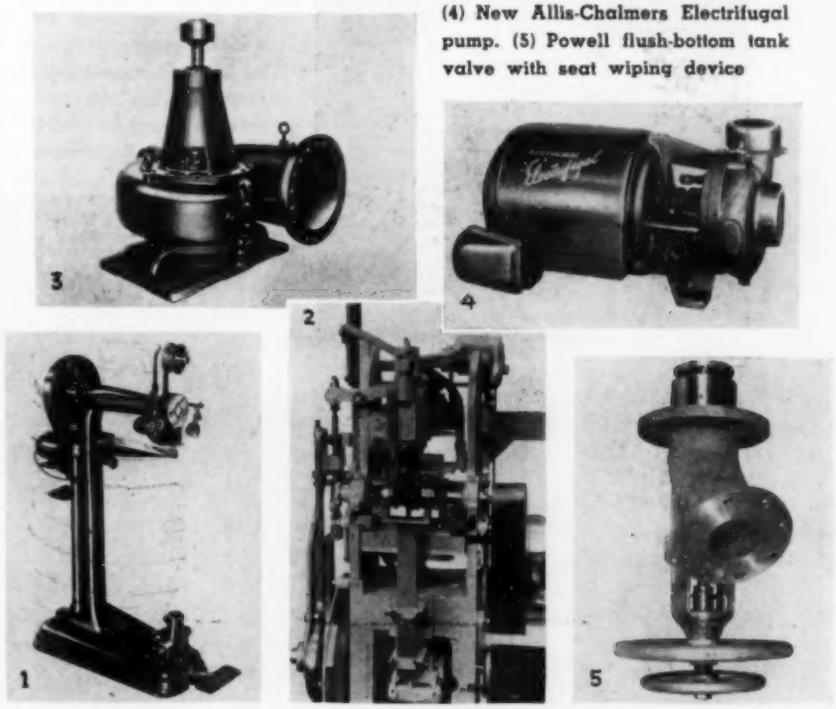
Allis-Chalmers Mfg. Co., Milwaukee, added several new models to its SSU line of close-coupled pumps. Among these was a two-stage pump with 4-in. suction and 2-in. discharge for capacities to 275 g.p.m., at heads up to 500 ft. Another Allis-Chalmers innovation in connection with close-coupled pumps was a new line known as Electrifugal. This type employs a special motor with a one-piece cast iron motor yoke and pump bracket, and with the feet cast integral with the housing and bracket, extending under the entire unit instead of under the motor only. Splash-proof motors are standard with totally-inclosed, fan-cooled motors and explosion-proof motors available if desired.

Shortage of alloy metals frequently used for water service piping need not hold up the installation of such piping, according to American Smelting & Refining Co., New York. About five years ago the company started development of a lead alloy especially for this purpose. This alloy is now being produced as extruded tubes in a range of nominal sizes from ¾ to 2 in. Known as Tube-Loy, these tubes are said to be superior to copper for the purpose, and better than lead for water service in strength and ductility. Prompt deliveries as compared with other materials are expected.

V-type is the designation of an improved variety of diaphragm pump which was developed by the Dorr Co., New York. The distinctive feature of this pump lies in the fact that the stroke of the plunger rod, and hence the rate of sludge discharge, may be varied at will while the pump is in operation, by means of a simple hand crank. The design is of two-chamber V-construction, with individual suction and discharge connections for each chamber.

Many improvements in centrifugal pumps were announced by Fairbanks, Morse & Co., Chicago. Among these is a line of non-clogging centrifugal pumps in sizes from 2 to 5 in., for sump and bilge service. The vertical-shaft centrifugal, which is basically this company's non-clogging trash pump, is suspended from the motor base by a supporting column through which the shaft runs and in which the drive shaft bearings are accurately aligned. Another new type,

(1) New combination Silverstitcher built by Acme Steel Co. (2) New Jersey Machine Co.'s double Pony Labelrite. (3) Fairbanks, Morse Angleflow pump. (4) New Allis-Chalmers Electrifugal pump. (5) Powell flush-bottom tank valve with seat wiping device



types for large capacity pumping at low head. Design is intermediate between that of a centrifugal and a diffuser type of propeller pump, with flow through the impeller at an angle to the axis of rotation. Standard sizes range to 54 in. discharge. Another new line appears in the company's mixed-flow pump for large-capacity, moderate-head work. These pumps employ a propeller and diffuser vanes in a construction similar in appearance to a deep-well type of centrifugal pump. They are suitable for capacities up to approximately 60,000 g.p.m., and heads to 40 ft.

Several new pump designs were introduced by Lawrence Machine & Pump Co., Lawrence, Mass. Among these is a lined slurry pump for handling highly abrasive slurries and mixtures containing abrasive solids in suspension, especially where high pressures are involved. The inner liner of hard alloy resists the abrasion while the outer casing is designed only to resist the pressure. A new top-suction centrifugal with vertical shaft and direct drive, has been designed for handling volatile or boiling liquids which would cause vapor binding with other types of construction. Provided some pressure is maintained on the suction, it is stated that this pump cannot become air bound. Another type is a vertical non-plugging, non-clogging sludge pump with direct-connected motor for use where extreme compactness is desirable and where there may be danger of flooding or splashing the motor. Still another design is a non-clogging horizontal-shaft centrifugal, developed especially for explosive plants for the handling of sludges containing large solids in suspension.

Development of a metal-coating method known as the Merchrome process enabled the Merco-Nordstrom Valve Co., Pittsburgh, Pa., to build lubricated plug cocks to operate successfully at temperatures as high as 1,000 deg. F. In this process a coating consisting of a complex metal alloy said to be of extreme hardness and corrosion resistance is welded to the rotating surfaces of the plug and body to give an inseparable bond. Valves for high pressure service have the plugs lapped into the bodies at a temperature corresponding to that of the intended service.

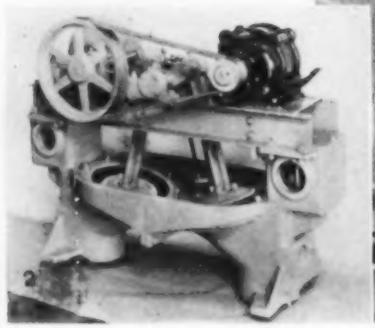
An improved high tensile plastic construction material called Olivex was announced by Oliver-United Filters, New York, for use in some sizes of its Olivite acid pumps. In the new design, the impeller, resilient sleeve, split gland and lantern ring are all made of the new plastic, permitting a change in design resulting in a 20 to 25 percent increase in efficiency and up to 5 percent increase in discharge head. The plastic is made by Durez Co.

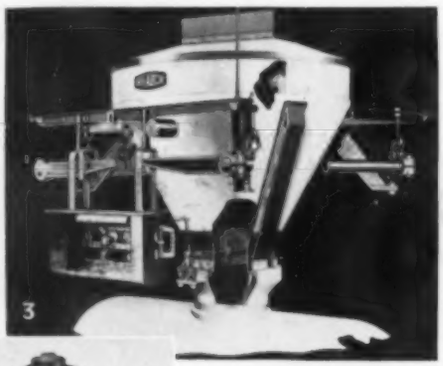
In recent years the Wm. Powell Co., Cincinnati, has developed a variety of new designs of flush-bottom tank valves for use on tanks, autoclaves and kettles of all kinds, with and without jackets. One new design is a type equipped with an auxiliary handwheel to rotate a patented valve-seat wiper, thus clearing seat and disk of any adhering material. Another type is gear-operated for operation from the side of the tank. A feature of these valves is that the valve proper is in one complete unit, facilitating easy removal for inspection or regrinding, if necessary. They are built in sizes from $\frac{3}{4}$ to 8 in.

Extensive enlargement of its line of proportioning pumps in recent months has been announced by Milton Roy Pumps, Philadelphia. New features of design include improved means of inclosing the step-valve chambers. Another innovation is a new pump stroke adjustment which employs a simple screw for varying the length of the drive crank. This construction is available on all pumps instead of standard equipment and is furnished as standard on high pressure pumps. Another improved adjustment incorporates a handwheel for setting the stroke and a vernier dial to facilitate quick and precise resetting. The company has recently built plastic liquid ends for its pumps as well as pumps for pressure as high as 20,000 lb. per sq. in. A new triplex proportioning pump will be shown for the first time at the Chemical Exposition.

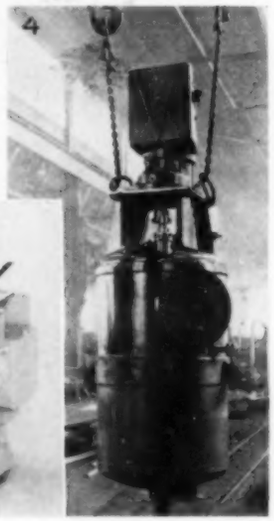
New all-purpose, ball-bearing, sanitary pumps employing such features as slow speed, positive displacement, quick cleaning, a rotary seal and ability to pump heavy, viscous products have been developed recently by Waukesha Foundry Co., Waukesha, Wis. The pumping mechanism consists of a pair of timed rotors operating in close clearance without mechanical contact.

(1) Lawrence Machine & Pump Co.'s vertical top-suction pump. (2) Dorrco V-type duplex adjustable diaphragm pump





(3) Read improved dustless weigh hopper. (4) Linseed oil blowing vessel with four-speed motor, for different agitator speeds, built by Hendrick Manufacturing Co.

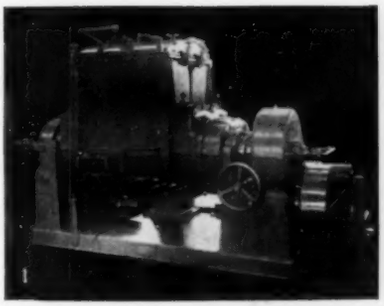


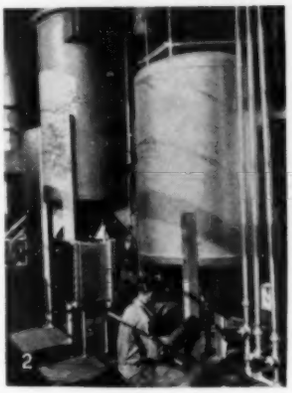
REACTION EQUIPMENT

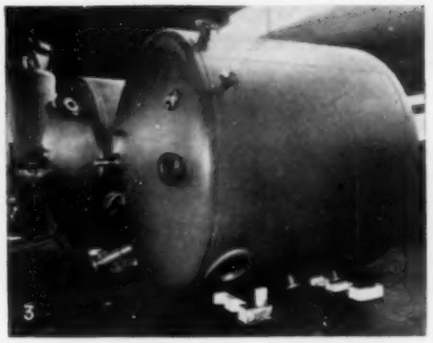
A considerable number of new processes, often involving new equipment to carry them out, have been developed by Blaw-Knox Co., Pittsburgh. One of these was a process for the recovery of methyl-ethyl ketone from air containing considerably less than 1 percent by volume of the ketone. The chemical is absorbed in water, then stripped and concentrated to produce the constant boiling mixture with water, which is dehydrated by a special process and finally fractionated to produce the anhydrous ketone.

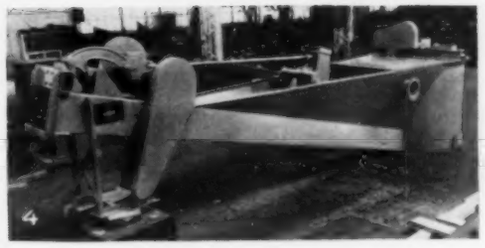
Another new recovery process is for ethyl alcohol vapor in air. It was developed primarily on the basis of detailed knowledge of the vapor pres-

(1) Read single-stuffing-box double-arm vacuum mixer. (2) Koven equipment for extraction and solvent recovery









(3) Hendrick cottonseed oil hydrogenators. (4) New Dorrco slaker-classifier combination

sure relationships and the use of improved methods of automatic control. The company has been active in the development of equipment for synthetic rubber from butadiene and styrene or acrylic nitrile and also has designed improved equipment for making synthetic acetic acid and acetic anhydride. Several Blaw-Knox developments were in connection with vegetable oils. The company worked closely with Pittsburgh Plate Glass Co., which has been a pioneer in the development of new procedures for selective solvent extraction of glyceride oils, such as soybean oil for production of excellent drying oils and improved quality edible oils. The company also developed new equipment and procedures for solvent extraction of vegetable oils, and a continuous vacuum stripping column method of steam distilling vegetable oils by means of superheated steam.

Improvements in plant and equipment for the synthetic resin industry were also introduced with the construction of numerous kettles using various means of heating, and equipment for storage and handling of liquefied gases, for gas absorption, for the dry blending of fine solids and powders, for the agitation of large volumes of liquids containing fragile crystals, and for the evaporation of heat-sensitive substances.

A new piece of combination process equipment is the Dorreo slaker, manufactured by the Dorr Co., New York, which combines in a single unit a covered and vented circular tank agitated by a Turbo mixer, in which slaking takes place, direct connected to a rectangular sloping compartment equipped with a Dorr classifier mechanism. This unit, which is now said to be widely used in chemical pulp mills in recausticizing operations, replaces the old set-up consisting of an individual rotary lime slaker connected with an individual classifier. The unit is said to afford continuous production of a smooth, grit-free suspension of milk of lime at 98–99 percent through 100 mesh and a dilution of five or ten to one.

Among the various improved designs introduced by Hendrick Mfg. Co., Carbondale, Pa., were several devices for the vegetable oil industry. Newly designed hydrogenators for manufacturing vegetable oil shortenings featured bearings protected against infiltration of the catalysts used; the use of injection mixers, to obtain maximum absorption of hydrogen; the use of special draft-tube assemblies to recirculate gas lying above the liquid level; and special coil arrangements to permit operation of the vessel at various charge capacities. A new vacuum bleach tank design for oil decolorization featured also improved agitation means through the use of draft tubes and turbine type mixers, with protection of the bearings and heating coils adapted to varying capacity operations. New oil-blowing equipment, which is said to have reduced the blowing time by one-half to two-thirds, featured similar agitation improvements coupled with the use of multi-speed agitator drives, to adapt the speed to the phase of the process. The company developed a variety of new methods of using draft tubes for mixing in different classes of operation. Draft tubes can, for example, be used to prevent sedimentation of heavy non-soluble solids; to extend the effect of agitation downward from the agitator to avoid too long a shaft; to recirculate gases which collect above the liquid level; to improve mixing above the agitator where lightweight non-soluble solids tend to float to the surface; to control the entrance of materials charged to a continuous mixer; and to establish the circulation path over coils, etc.

The company also investigated the effect of new types of radial baffle assemblies and arrangements in connection with turbine type agitators, using them to control settling or elevating tendencies of solids, separation of immiscible liquids, rising tendency of gas bubbles, and the position of the reaction zone. In the case of continuous reactor problems the company has been emphasizing the use of external forced-circulation heating and cooling to reduce the size and cost of the reaction vessel, and improve and control heat transfer.

In its function of designing and building special equipment for the process industries, L. O. Koven & Bro., Inc., Jersey City, N. J., produced numerous special designs during the last two years. One, for example, was an all stainless steel still and condenser built for a maker of biological chemicals. The charge in the still is agitated and mixed by two adjustable propellers mounted on a shaft driven by a gear-head motor. The kettle itself is jacketed for steam or hot water and the ascending vapors pass first through a reflux condenser and a second larger condenser. Condensate from the second can either be refluxed or discharged from the equipment. Another development is a combination extractor, solvent recovery still and decantation tank for making fine chemicals and pharmaceuticals. Stainless-clad steel was used and special features of the design include an adjustable decanting device and a stainless steel look-box with shockproof glass front and rear to permit the operator to watch the decanted liquor and control the position of the decantation funnel by noting the degree of clarity.

Among the various equipment developments of Patterson Foundry & Machine Co., East Liverpool, Ohio, should be mentioned a new gas absorber designed for relatively high internal pressure and fitted with three gas-absorber turbine agitators. In the field of heavy mixing and kneading equipment, the company developed the Kneadermaster line of double-arm mixers, built in a large number of different combinations of frames, sizes and horsepowers for medium and heavy-duty operations.

Among the new designs introduced recently by the Pfaudler Co., Rochester, N. Y., is a line of one-piece, jacketed, glass-lined steel reaction kettles. The new line includes two series, the standard type designed for pressures up to and including 50 lb. per sq.in. and a special series for much higher pressures, as required. Built to code requirements, these vessels have a number of special features such as special reinforced openings and, if needed, a new design of high-pressure stuffing box. One of the high-pressure kettles of 500 gal. size, equipped with glass-coated baffles and an impeller agitator with direct motor drive will be displayed at the Chemical Exposition. The company also has had occasion to build a considerable number of glass-lined rotary dryer shells for the drying of products requiring protection from all types of corrosion.

Only a single packing gland is employed in a new line of double-arm vacuum mixers developed by Read Machinery Co., York, Pa. This single gland is far removed from the material being mixed and the material itself is retained in the mixing compartment by means of split seals mounted on the arm shafts at the bowl ends. Vacuum chambers at either end of the bowl are arranged to eliminate all possibility of pulling air or vapor through the product being mixed. The mixing arms are of a self-cleaning design. Bowls may be fully or partially jacketed and the mixing arms internally heated or cooled, if desired. These mixers are of the tilting bowl type. Another improvement introduced by this company is found in its dustless automatic weighing hopper. In the improved type, as quick-acting butterfly gates are opened by a quarter turn of the gate handle for discharge of the hopper contents, a sliding sleeve automatically lowers to make direct contact with the equipment into which the hopper contents is being discharged. As in earlier models, the displaced air and the dust it carries are vented back into the hopper by an external vent duct.

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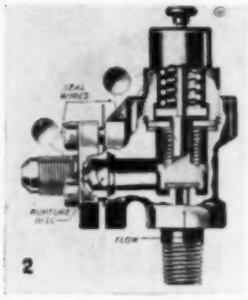
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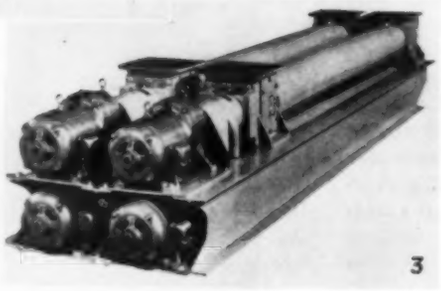
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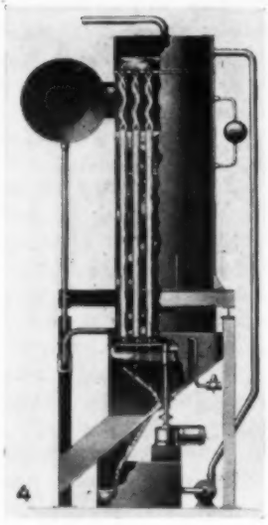
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(1) Fairbanks, Morse evaporative cooler. (2) Black-Sivalls & Bryson safety valve-rupture disk combination. (3) New cement cooler made by Fuller Co.

(4) Henry Vogt Machine Co.'s Tube-Ice maker

REFRIGERATION AND COOLING

New models of evaporative coolers for the cooling of jacket cooling water for internal combustion engines were announced by Fairbanks, Morse & Co., Chicago. These units consist essentially of a coil through which the jacket water is passed, nozzles to spray water on the coil and a blower to force air past the coils. The heat of the jacket water is absorbed by the air through direct transfer and by evaporation of water on the coil surface. Automatic, semi-automatic and manual types are available.

A new product introduced by the Fuller Co., Catasauqua, Pa., was a water-cooled cooler for portland cement and other pulverized materials. These coolers comprise assemblies of parallel cooling units, each unit having a capacity of 50 bbl. of cement per hour. Each unit consists of a pair of water-jacketed casings, each casing surrounding a cooling tube of wide diameter through which the cooling water circulates. The space between the tube and jacket is narrow to expose the cement to a large area of cooling surface. The hot cement enters the cooler through a flanged inlet casting and is advanced through the upper casing by narrow screw flights on the cooling tube, from which it discharges to the lower casing through a connecting casting, the cement returning through the lower casing and discharging directly below the inlet. Temperature drops ranging from 100 to 150 deg. F., depending upon initial cement temperature, are reported for coolers in commercial service.

A totally new sort of ice-making equipment, to which has been given the name Tube-Ice machine, was brought out by Henry Vogt Machine Co., Louisville. Units are built in any size desired, starting at 3 tons per day capacity. The machine produces ice in the form of short cylindrical lengths of relatively small diameter, either hollow or solid. The cylinders are produced by freezing water in vertical tubes in a cycle of alternate freezing and thawing.

The machine consists of one or more vertical tubular shells, containing tubes, with a pump for delivering water at the top of each shell, from which it flows downward along the inside walls of the tubes and into a water tank below. The refrigerant is admitted into the shell and surrounds the tubes, thereby freezing the water and producing cylinders of ice in the tubes. A timing mechanism operating through valves automatically controls the functions of the machine in an adjustable cycle permitting either hollow or solid cylinders to be produced. The ice is freed from the tubes by removing the refrigerant from the shell by admitting high-pressure warm gas from the condenser, causing a slight melting at the tube surface. The cylinders of ice, after thawing, drop by gravity to a revolving cutter which shears them to the desired length and discharges them into a bin or other receptacle.

Worthington Pump & Machinery Corp., Harrison, N. J., developed a new type of liquid-cooling system for air conditioning and industrial process requirements. The centrifugal compressor is of the volute design, rather than the diffuser type heretofore used in centrifugal refrigeration. Many new features are employed such as dual lubrication and balancing of end and side thrust by arrangement of impellers and volutes. Capacities range from approximately 150 tons refrigerating effect to 1,200 tons.

SAFETY AND FIRE PROTECTION

A gas-tight pressure release device intended particularly for use on refrigeration systems and available in the ½-in. size for pressures to 300 lb., was developed by Black-Sivalls & Bryson, Inc., Kansas City, Mo. This device consists of a spring-loaded relief valve which is normally open, in series with a pure silver rupture diaphragm. When over-pressure occurs, the diaphragm ruptures. Upon rupture the relief valve becomes a spring-operated device which closes after pressure in the system has dropped to the valve setting. The relief valve then holds the gas until a new rupture disk can be installed.

Further development of the bulk CO_2 system of fighting fires was made during the period covered by this report by the Cardox Corp., Chicago. The company reports that numerous installations are now being made in the chemical industry for the handling of large fires in such flammables as benzene, naphthalene and other organics. The Cardox system maintains a large supply of liquid carbon dioxide at the point of hazard, storing it at low temperature and low pressure under the action of refrigeration. In the event of fire, the carbon dioxide is released rapidly and in large quantity with the claimed advantages of rapid smothering of the fire, plus a large cooling effect owing to rapid expansion.

Particularly for use in chemical plants, refineries and other places where regular cotton-covered fire hose would be quickly destroyed is a new rubber-covered fire hose put on the market by Goodall Rubber Co., Philadelphia. It is made in 1½ to 3 in. sizes and guaranteed for a 400-lb. test pressure. Another new product of this company is a line of lightweight, low shoes for workers in chemical plants where the floors are wet with acids or other chemicals. These shoes are made of rubber, in appearance similar to an oxford, and are provided with a metal toe box capable of withstanding more than 3,000 lb. pressure, according to the manufacturer.

Many new types of safety equipment were introduced by Mine Safety Appliances Co., Pittsburgh. Typical examples include an improved self-contained, explosion-proof, combustible-gas alarm of the type employing a balanced electrical circuit in which are two heated platinum filaments. The sample, drawn over one of the filaments, burns when combustibles are present, thus increasing its temperature and unbalancing the circuit in proportion to the concentration of combustibles present. A new diaphragm pump with non-sparking motor and an explosion-proof case is used for the sampling. Operation of a recorder as well as an alarm can be accomplished. Another instrument, a simplified combustible gas indicator, uses a simple electric circuit, featuring a single filament and single control knob operated on standard flashlight batteries and easily controlled with one hand when used in portable service.

Since the last Chemical Exposition, the Pioneer Rubber Co., Willard, Ohio, has greatly enlarged its use of neoprene in the manufacture of safety clothing for industrial use. Many new items have been added to the company's line of neoprene gloves and mittens, including all-white neoprene gloves of heavy construction for workers in pharmaceutical and food industries.

SEPARATION OPERATIONS

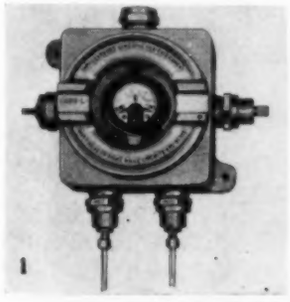
As a means of achieving extremely low driving power, in proportion to output, in a vibrating screen, Allis-Chalmers Mfg. Co., Milwaukee, introduced a new principle in the use of a revolving eccentric shaft carrying flywheels which themselves do not gyrate, since the shaft is so turned that their center of rotation coincides with the center of gyration of the screen body.

This screen, which is known as the Ripl-Flo, is thus claimed to have high capacity on heavy granular materials such as cement, coal and chemicals, yet to be particularly smooth in operation.

An improved type of electrostatic separator employing a rotating dielectric electrode was developed by H. L. Bullock of Bullock, Smith & Associates, New York. The machine does not differ materially from conventional types of electrostatic separator with the exception of the new electrode.

In those machines available in the past, rods, tubes or wires of conducting material, with or without an insulating covering, were used as electrodes. When insulated electrodes were required, extremely high direct-current voltages were required and various other difficulties were encountered such as transmission of local disturbances to all electrodes, heavy losses of static charge during

(1) New combustible gas alarm built by Mine Safety Appliances Co. (2) Magnetic Engineering & Mfg. Co.'s multiple cross-belt magnetic separator. (3) Allis-Chalmers Ripl-Flo screen. (4) Frantz permanent magnet FerroFilter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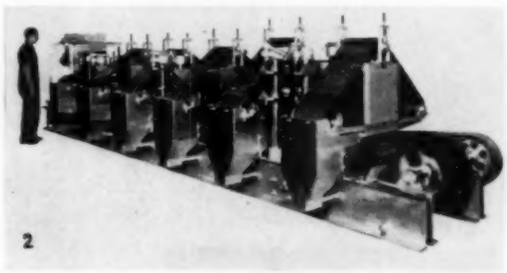
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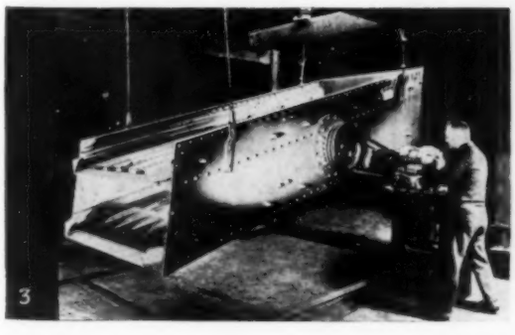
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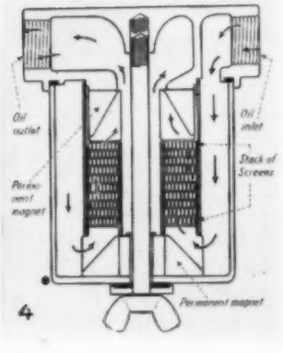

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damp weather, and a certain degree of danger to the operators.

The new electrode is in the form of a rotating roll made of highly dielectric material. A surface charge of the desired polarity is produced on the side of the roll away from the point of separating action and then rotation of the roll carries the charged surface to the point where separation is taking place. The roll is charged by means of a high-tension conductor removed from the frame of the machine. In the sphere of action, the charged non-conductive surface attracts particles carrying charges of opposite sign, some of which adhere to the roll and are carried around to a point where they can be scraped off. Particles which are not attracted are thus separated by means of a divider as they drop from the feed roll. Ordinarily six or more stages will be necessary. Typical separations possible with such equipment are said to include the cleaning of seed, the separation of various types of abrasive grains, and separation of certain minerals such as ilmenite and rutile from zircon, and feldspar from quartz.

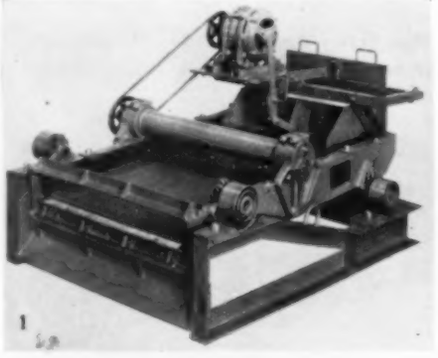
The Denver-Dillon vibrating screen, a recent development in the mining field, is now being employed in a number of process industries. This product of the Denver Equipment Co., Denver, is a screen of the corner-suspended type vibrated by means of what is described as a floating-circle-motion mechanism. The screen body is eccentrically mounted on a concentrically rotatable shaft with only two bearings required, and these at the eccentric positions. The type of circle motion and the static and dynamic balance claimed for the assembly, coupled with the spring-cushioned, rubber-insulated suspension rods, is said to isolate the motion of the screen from the structure and also to relieve the shaft and bearings from overly heavy loads.

A second new Denver Equipment development in the field of separation is the company's Hydro-Classifier. Several of these machines are now operating in the phosphate field and on other non-metallic products. This unit is a shallow settling tank with peripheral overflow and spiral rake, designed for fine sizing and regularly built in diameters from 8 to 30 ft. The machine operates as an overloaded thickener, with the fine material overflowing and the coarse material removed from the bottom as a sludge.

Recent developments of the S. G. Frantz Co., New York, include a magnetic separator FerroFilter for free-flowing dry materials, as well as a permanent-magnet type intended especially for removing magnetic particles from lubricating oil, hydraulic and coolant systems. The dry FerroFilter follows the general principles of this company's screen type wet FerroFilter, consisting of a stack of iron grids strongly magnetized by a direct-current coil. The grids are made with sloping vanes which divide and retard the flowing stream of material. Alternate grids have vanes sloping in opposite directions so that the material moves through in a zig-zag course giving every particle a good opportunity to be caught by the sharp magnetized edges of the vanes. The permanent magnet type is self contained and requires no electric power. A stack of screens, similar to those used in the company's standard type of wet separator, is energized by two powerful permanent magnets.

An improved arrangement of its air separation ball mill was developed by the Hardinge Co., York, Pa., in connection with a new device known as a Loop Classifier. The new system is a modification of this company's reversed air current system, so employed that only clean air passes through the fan. Air sweeps into the mill through the discharge trunnion, reverses and picks up fines which are carried out through a pipe concentric with the air inlet. Fines pass into a centrifugal classifier, past a splitter damper which adjusts the fineness. Oversize drops out for return to the mill feed end, but before doing so is cleaned by a current of air passing upward through the falling oversize. Fines are collected in a cyclone separator and the air returned to the mill in closed circuit. According to the manufacturer classifications as coarse as 20 mesh, or as fine as 99 percent through 200 mesh, can be obtained.

Several improved magnetic separation devices were announced by Magnetic Engineering & Mfg. Co., Clifton, N. J. Among these was an improved type of cross-belt separator. Material to be separated is fed from the feed hopper on to one end of the main conveyor belt in a uniform and even stream. The main conveyor carries the materials under the several separating magnets, suspended over the main conveyor belt. Magnetic material is lifted out of the stream but cannot reach the suspended magnets owing to a traveling cross-belt which carries the magnetic material off to one side where it is discharged. This unit is built in many sizes, with from two to twelve cross-belts, each magnet having its separate coil and electrical and mechanical controls. Increased working capacity is said to result from the use of specially designed magnet pole points. The separation and concentration of tungsten and ilmenite ores and the removal of contaminating magnetic particles from fluorspar, abrasives and similar prod-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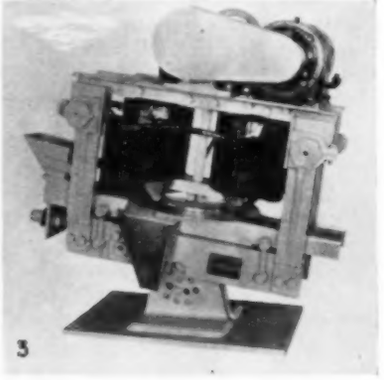
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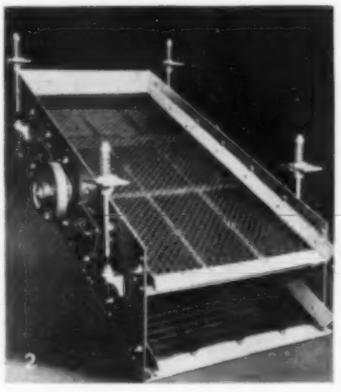
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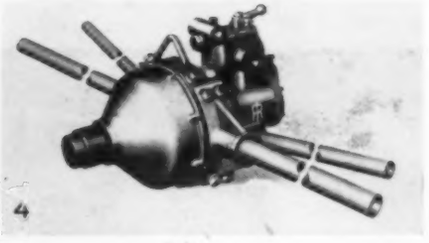
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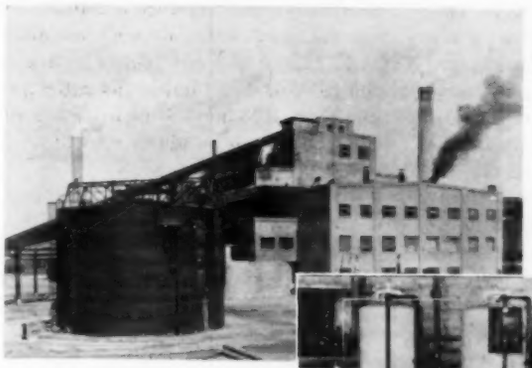
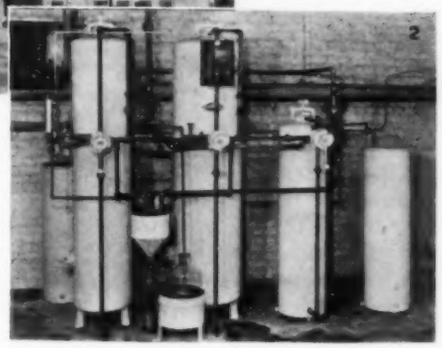
(1) Overstrom mud screen. (2) Denver-Dillon screen. (3) Magnetic engineering type VT separator. (4) Ingersoll-Rand flue roller



(1) Dorrco Hydro-Treater in a southern pulp mill



(2) Illinois Illco-Still for producing "synthetic distilled" water by chemical processing

ucts are the functions of the new machine.

Another recently designed separator offered by this company is intended for magnetic separation and ore concentration. Available with carrying trays ranging from 4 in. to 24 in. in width, the unit operates as follows: material to be separated is loaded into the feeding hopper from which it flows on to a tray actuated by eccentrics, and moving with a reciprocating motion. Material is carried down the tray under suspended magnet poles and under a revolving disk which carries magnetic material off to the side of the separator. Non-magnetic material travels down the tray and is discharged at the end. The number of magnetic poles used depends on the number of magnetic products required.

In order to insure circular motion of the entire screening surface and also to permit greater length of screen surface to be used, Productive Equipment Corp., Chicago, has devised a new model of Selectro vibrating screen fitted with double vibrators of the unbalanced weight and eccentric type. These double vibrating units are arranged with a set of vibrators at each end of the screen, the vibrators arranged to be driven through helical gears on a longitudinal shaft running at the side of the screen. The gear drive permits driving both vibrators from a single point and also insures both vibrating units operating in synchronism at all times. The vibrating units are this company's standard type, having eight degrees of adjustment between zero and $\frac{3}{8}$ in. throw. According to the manufacturer, the motion of these screens can be regulated so accurately that they can be used for separations which previously required the use of jigs, tables and other equipment. Indicative of the fact that extremely long screens may be driven in this fashion, it can be noted that standard sizes of screen decks range from 3x12 ft., up to 5x24 ft. Such screens are available in one, two and three deck construction.

New developments reported by Separations Engineering Corp., New York, from among the types of equipment of various manufacturers handled by this concern, were largely in the classification of new uses rather than design changes. The air table manufactured by Sutton, Steele & Steele, Dallas, has been applied to a large number of new uses in commercial installations, functioning in the separation of a mixture of galena, sphalerite, fluorspar and silica; gun powder, brass skimming, aluminum dross, zinc dross, quicklime; silica gel, pyrite, brookite, chromite, cassiterite; mill scale; copper dust; ferro silicon; roofing granules; karaya gum, damar gum, tobacco stems; various prepared breakfast and baby foods. The Electro-Float electrostatic separator made by the same company is now being employed in making separations of stainless steel grindings from abrasive grains; separating pyrite from scheelite without roasting; separating various kinds of abrasive grains by differences in electrical conductivity.

The separation equipment made by the Exelon Co., Blasdell, N. Y., has also gone into new applications. That company's induction magnetic separator has for example been used in purification of aplite, and the company's multiple screen unit, the Multi-Form Grader, is being used on separations in connection with such materials as tartaric acid, fluorspar, stainless steel grindings and brass skimmings.

Other new developments among products handled by this concern include the Overstrom mud screen made by Overstrom & Sons, Los Angeles, and a new super-size Overstrom concentrating table of 8x30 ft. dimensions. The wet screen consists of a screen box supported on large spiral springs, with an unbalanced shaft vibrator mounted on the screen box. Far greater capacity on ceramic slip and oil well mud screening is claimed than has been possible with previous equipment. The new wet concentrating table is of tremendous capacity and employs a curvilinear type of motion for the deck, with the riffling curved to suit this motion.

Also announced by Separations Engineering Corp. is a new permanent-magnet-type pipe-line separator for the magnetic treatment of ceramic glazes and slips, pigments, vitreous enamels, food products, lubricating oils and other liquids. It is manufactured by Magnetic Products Co., Trenton. Known as the Model PB Separmag it is energized by a self-contained permanent magnet of Alnico.

TOOLS

Along with a number of improvements in a variety of air-operated tools such as drills, grinders and wrenches, Ingersoll-Rand Co., New York, introduced two new flue-rolling machines intended especially for rolling extra large tubes such as those used in oil refinery stills. These machines are designed to operate at low speed and give extremely high torque, powered by this company's Multi-Vane air motor.

In the field of maintenance equipment was a gas furnace of improved design for plumbing and pipe fitting, made by the Insto-Gas Corp., Detroit, Mich. The equipment consists of a gas burner with improved windshield to permit use on windy days, and supplied with a small cylinder of liquefied petroleum gas which is replenished by the company's gas distribution system.

Redesign of its stencil-cutting machine was announced by Marsh Stencil Machine Co., Belleville, Ill. Three sizes are available with $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. letters. Improvements for added convenience in use, quicker operation and less likelihood of errors by the operator were the basis of the redesign.

WATER TREATMENT

Several new pieces of water treatment equipment were developed by the Dorr Co., New York. The Hydro-Treator is a self-contained water treatment unit for purifying industrial water supplies by means of softening, turbidity removal or color removal. The feed enters at the bottom through orifices in a rotating distributor element, immediately above which is a mechanical agitating zone in which flocculation takes place. After flocculation the clarified water overflows at the top of the unit through an annular effluent channel, while the solids settle into a central sludge cone where they are thickened and withdrawn through a sludge pipe. A substantially constant amount of solids remains suspended in the flocculation zone to form a sludge blanket for the entrainment of fine solids. Thus in one unit the three steps of flocculation, thickening and clarification are carried out, rather than in the three pieces of equipment ordinarily used for large installations.

Another mechanism, now being used chiefly in the field of industrial water and waste treatment, is the Dorreo Monorake, a new oscillating mechanism for installation in rectangular sedimentation tanks. The function of this equipment is the same as that of the standard Dorr thickener and classifier. The oscillating raking mechanism is suspended from a carriage which spans the tank and runs backward and forward on rails, motivated by steel cables driven by a stationary motor unit. On the raking stroke, the rake blades just clear the bottom and move the settled material into a hopper at one end. On the return stroke, the rakes are lifted to clear the accumulated sludge.

Still another Dorr development for water treatment is the Clariflocculator, a unit providing in a single tank both flocculation and clarification. Intended for the purification of industrial water and the treatment of industrial wastes, the unit consists of a circular-tank clarifier with a mechanical flocculator in a circular inner compartment. Feed enters at the center and is stirred gently by the slowly moving flocculator blades. The flocculated material then passes into an outer annular compartment where settling and clarification take place.

Illinois Water Treatment Co., Rockford, Ill., announced a process and equipment for producing water substantially free from dissolved materials, approximately equal to single-distilled water, by chemical methods. This process is of the new type employing hydrogen exchange and absorption coupled with hydroxyl exchange and absorption, in successive steps, followed by removal of the carbon dioxide remaining dissolved in the water by aeration or chemical exchange and absorption. Describing the process as "synthetic distilling," the company provides Illco-stills in sizes ranging from 100 to 5,000 gal. capacity per hour to operate at a complete cost, including chemicals for regeneration, labor, depreciation and maintenance, of but a few cents per 100 gal. In operation water passes through two reactor tanks. A hydrogen exchange reaction in the first tank substitutes hydrogen for the positive ions such as calcium, magnesium and iron. The water then passes to a second tank where a hydroxyl exchange chemical substitutes the OH ion for the negative ions such as chloride, sulphate, etc. The minerals removed from the water are retained in the reactor tanks until regenerated. The hydrogen exchange material is regenerated with a commercial grade of acid, and the hydroxyl exchange material with an alkali solution. The resulting water is said to contain from 5 to 15 p.p.m. of total dissolved solids.

The equipment is constructed of corrosion-resisting materials, the two main tanks and piping being made of Everdur or Herculoy and the remaining piping of brass or copper. An electrical control continuously indicates the purity of the treated water. The equipment may be shut down manually for regeneration or the electrical control may be arranged to accomplish this automatically.

Water approaching distilled water in its low concentration of dissolved solids is also being produced by the De-Mineralizing process recently perfected by the Permutit Co., New York. In the original sodium zeolite process for water softening, calcium, magnesium and other cations were replaced with sodium ions picked up from the zeolite. The new process employs a hydrogen ion exchange material whereby the water gives up its calcium, magnesium and sodium ions which are replaced by a corresponding amount of hydrogen ion. The carbonic acid formed decomposes and the carbon dioxide may be removed by aeration. The acid formed may be removed by blending with a sodium zeolite softened water or with an alkali. Thus where the raw water is low in chlorides and sulphates, the water produced by this method approaches distilled water in quality according to the manufacturer.

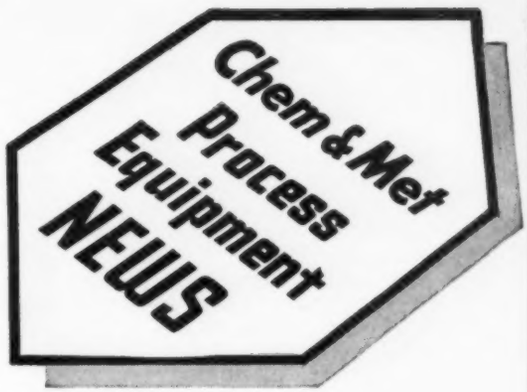
In the latest version of this process, chlorides and sulphates are also eliminated. This new step is known as the De-Acidite step. In it the entire acid molecule is absorbed, rather than yielding an ion exchange. When the absorption material requires regeneration, this is accomplished with an alkali such as soda ash. The precise composition of the effluent possible with this process depends to some extent upon the quality of the raw water, but in general, according to the company, it can be reduced in total hardness, expressed as calcium carbonate, as low as 0–2 p.p.m., with reduction in chlorides to 2–8 p.p.m., and in sulphates to 2–4 p.p.m.

New equipment for water softening produced by the company includes an improved spray type deaerating heater and a new cold-process lime-soda softener to which has been given the name Spiractor. The new deaerating heater has the function of removing oxygen and free CO_2 from boiler feed water by direct contact with steam. It is claimed that in operation, regardless of the amount of oxygen initially in the feed water, its concentration in the deaerated water is reduced to substantially zero. The new softening process employs a new principle described as catalytic precipitation. Besides hastening the process to less than five minutes, a charge of catalytic granules serve as nuclei around which the precipitating compounds of calcium and magnesium build up to avoid formation of a voluminous wet sludge. The granules grow owing to the deposits and can be readily removed or, in fact, can be crushed and re-used.

A conical steel shell is partially filled with the screened catalytic material. Raw water and the usual chemicals are introduced at the lower end of the cone through tangential inlets. As the velocity and turbulence of the rising water decrease at a higher elevation in the cone, a point is reached above which the catalytic particles are not suspended. At this point the reaction has been completed. The new softener is much smaller than previous cold type lime-soda softener designs. It is readily adjustable to changes in character of water, has no moving parts, requires no repumping and eliminates sludge handling.

Reprints of this 40-page report are available at 25 cents per copy. Address the Editorial Department, *Chem. & Met.* 330 W. 42d St., New York, N. Y.

Machinery, Materials and Products

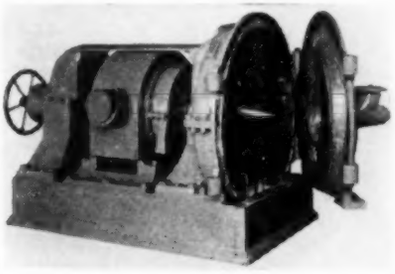


Rotary Disk Mill

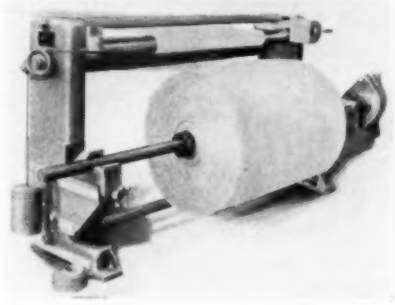
DESIGNED for use in pulp mills is a new rotary-disk grinding mill, Type 36-2, recently announced by Sprout, Waldron & Co., Muncy, Pa. The machine is designed for use on knotter and fine screen rejects, semi-chemical chips, spent chips and roots from extraction processes, deinked stock, bagasse and similar materials, and cooked chemical pulps. Its purpose is to break down the chips, knots and bundles of fibers to pass a given screen, at the same time giving some incidental hydration. If desired, after reduction to size the pulp may be sent to another similar unit, equipped with different plates, to secure a further reduction in freeness, plus improved strength.

The mill has one set of plates fixed to the mill shell and another set attacked to the rotating disk. Stock is introduced in the center between the grinding plates and discharges around the periphery after cutting, rubbing, and rolling have taken place between the bars of the plates. The plates operate at close clearance, but without actually touching. Clearance adjustment is provided by means of a handwheel which positions a movable outboard thrust bearing at the tail end of the built-in motor. Depending on service, the motor requirements range ordinarily from 75 to 300 hp. Capacity varies with the character of stock and type of service, ranging ordinarily from 10 tons per day of air-dry pulp to about 40 tons.

Rotary disk refiner



Hydraulic-brake unwinder



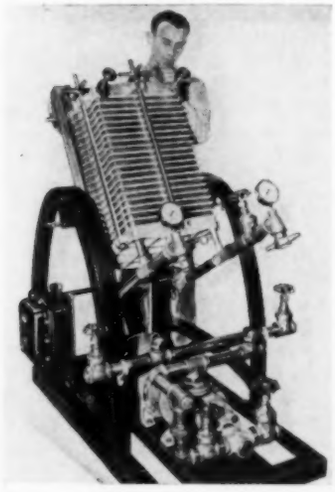
Combination Filter

COMBINING a sheet type and alluvial filter into a single unit is an achievement recently announced by American Seitz Filters, Paterson, N. J. The new filter, known as the "Flexmaster," is similar in appearance to a plate-and-frame filter press, but can be operated in either the horizontal or vertical position, as shown in the accompanying view. The frame of the filter is balanced on an axis in a sturdy stand and can lock in either a horizontal or vertical position. Loading of the filter is started with the frame horizontal. The plates are slid apart and the filtering medium or back-up material is slipped between the plates. The filter is then swivelled into vertical position and feed and discharge lines are connected tightly with special unions. Setting is now accomplished by using a pump and mixing tank and circulating a filter aid, such as diatomaceous earth, until the precoat is deposited on the back-up sheet or screen.

The filter plates are "double-acting" in type. When in the horizontal position, the top of the plate acts as a discharge chamber and the bottom as a feed chamber, with the medium between. The plates are screened on one side. Two feed and two discharge channels run inside the plates. The back-up material serves as an edge-sealing gasket. For cleaning the unit is tipped back to horizontal, the plates parted and the spent layers are stripped into a drip pan which is supplied.

Chief advantage of the new arrangement is prevention of collapse of the filtering layers, no matter how short the run. Another advantage is the possibility of quick draining with compressed air, while dual filtration, for example using diatomaceous earth deposited on a filter sheet, can be used for combining rough and polish filtration. Quick cleaning is possible.

Flexmaster filter partially tilted



Improved Unwinder

USE of automatically controlled hydraulic braking, to secure uniform unwinding tension under all conditions of speed and roll diameter, is a feature of a new type of uniform tension unwinder recently developed by Johnstone Engineering & Machine Co., Downingtown, Pa. This equipment is similar to earlier unwinders of this company's manufacture, except for the redesign and modernization of the various parts and the inclusion of automatic hydraulic braking.

The roll of material to be unwound (such as paper, board, fabric or rubber), is supported on a shaft to one end of which the hydraulic brake is coupled by a quarter-turn "twist coupling." The web is then threaded over a stationery roll and looped over a spring- or weight-counterbalanced "nerve roll" which measures the tension. This last mentioned roll is mounted in roller bearings in horizontal tracks which permit free lateral movement, forward or back, and is counterbalanced so that the traveling web tends to pull the roll in the direction opposite to the counterbalance pull. A differential reduction gear is employed to interpret the movements of the nerve roll, which are transmitted by an oil-filled master bellows to a relay bellows at the brake. The pressure magnification of the system is such that 1½ lb. tension on the web will produce a pressure of 1,200 lb. at the brake, according to the manufacturer.

For lighter-weight materials, on rolls from 32 to 62 in. wide, an air-cooled brake is employed. For heavier materials, on rolls from 52 to 92 in. wide, a water-cooled brake is supplied.

Anti-Sabotage Floodlight

FOR USE at guard fences around munitions plants and other strategic industrial areas, a new weathertight floodlight unit has been designed by Revere

Electric Mfg. Co., Chicago, Ill. The unit employs an aluminum reflector and fresnel lamp to produce an intense beam covering approximately 10 deg. vertically and 180 deg. horizontally. In use units are mounted at a height of 15 ft. on poles placed 150 ft. apart, set behind the guard fence. The beam is directed to clear the top of the fence with the beam center tilted 5 deg. from horizontal. This floodlighting is said to make an intruder clearly visible at a distance of 500 ft., while presenting only an impenetrable glare to the intruder from any angle of approach.

New Turbine Pumps

BOTH SINGLE- and two-stage pumps are included in a new line of Westco turbine pumps which has just been announced by Micro-Westco, Inc., Bettendorf, Ia. These new pumps feature an improved type of renewable liner which can easily be replaced (along with the impeller), thus providing what is in effect stand-by service at about one-quarter the usual cost of a duplicate unit. If necessary to change capacity and range within reasonable limits, the liners and impeller can easily be changed to a different set of suitable characteristics. The pumps feature double ball-bearing construction, top discharge to prevent vapor lock, stainless steel shafts and free-floating impellers, and extra deep stuffing boxes.

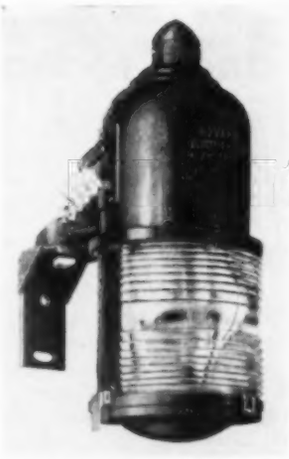
These pumps are designed especially for high-head, low-capacity work. For example, the 5-in. size at 1,750 r.p.m. develops pressures up to 150 lb. single-stage, and to 300 lb. two-stage. The manufacturer suggests their use in brine circulation, steam service, liquid transfer, filtration, air conditioning, booster service, spraying and similar applications.

Safety Elevator

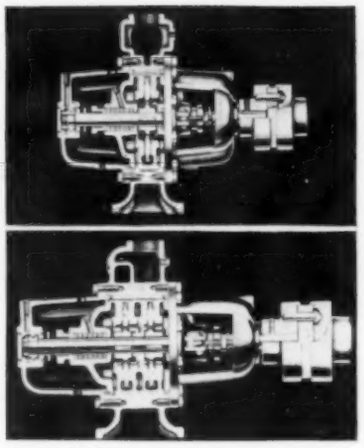
TO IMPROVE the safety of its hinged portable elevators, Lewis-Shepard Co., 245 Walnut Street, Watertown, Mass., has developed a spring balancing mechanism to facilitate handling the hinged section. Raising and lowering of heavy hinged upper sections is stated by the manufacturer to be clumsy, difficult and sometimes even dangerous with ordinary designs. Powerful compression springs within the balancing cylinders of the new design now enable one man to raise and lower the frame quickly. Spring balances can be used on hinged sections 8 ft. in length, and sometimes longer. They can be included in all of this company's new stackers of hinged types.

Equipment Briefs

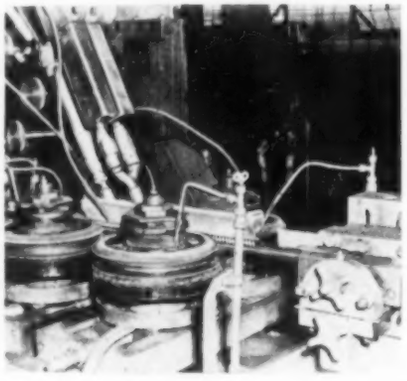
IN THE LAST TEN YEARS chlorinated-rubber-base paints have made important strides in the coating of concrete and wood. A recent announcement from the Truscon Laboratories, Caniff and Grand Trunk Railroad, Detroit, Mich., states that a paint of this type has now been prepared expressly for the protection of exposed iron and steel, as well as other metals such as aluminum, copper and galvanized metal. The new coating, Paratex Metal Coating, is expected by the manufacturer to replace conventional type metal paints because of exceptional durability and resistance to rusting and corrosion. In addition to being more waterproof than previous metal paints, the chlorinated metal base is said to give exceptional resistance to acids, alkalis, fumes and other chemicals. The paint is quick-drying and is said to incorporate only pigments which are either inhibitive or neutral to steel corrosion. Paratex metal primer, supplied by this concern for use under the metal coating film, is said to have the property of "lateral absorption," penetrating under scales of rust and paint which do not have true adhesion to the surface and turning up the edges for ready removal before final painting.



Anti-sabotage floodlight



Single- and two-stage turbine pumps



Oxyacetylene tube welder

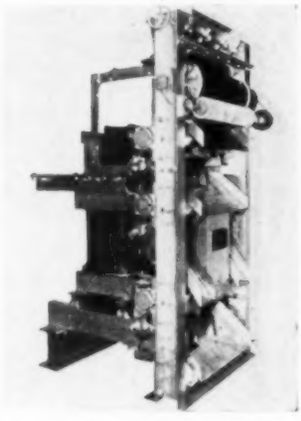
Through a new process developed by the Yoder Co., Cleveland, in collaboration with the Linde Air Products Co., New York, exceptionally high speeds in the production of low carbon, stainless and other alloy steel tubes can now be achieved through oxyacetylene welding. For example, 18-gage material is said to be welded at speeds up to 150 ft. per min. The forming-mill section of the tube welding machine is similar to that in earlier machines. Flat skelp is fed in through a series of forming stands, the formed tube then passing through the welding section shown here. After being welded the tubing passes through a water quench, then is straightened by rollers, and finally cut to length.

Spring-balanced stacker

A NEW polarimeter employing a Polaroid polarizer instead of the usual calcite prism has been introduced by the Spencer Lens Co., Buffalo, N. Y. Light passes from a monochromatic light source through the polarizer, lengthwise through a sample tube with molded plastic ends, and then through an analyzer, telescope objective and eye-piece. Three lengths of sample tube are available, all of which have enlarged ends to trap air bubbles. The polarimeter may be used with any monochromatic light source, although an orange filter to modify the light from a tungsten lamp gives light sufficiently near that of sodium for correct readings with many materials.

TO LESSEN EYE STRAIN in processes where workmen must watch recorder charts for considerable periods of time, the Permochart Co., 436 Chestnut Road, Sewickley, Pa., has developed a line of Permocharts in three colors of Viny-

Self-balancing temperature indicator



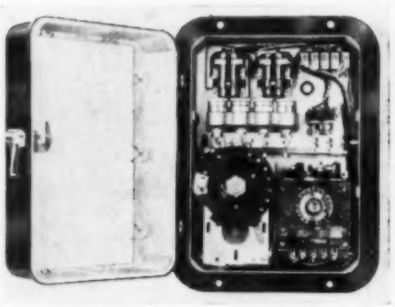
Three-high induction separator

lite plastic. The new charts, known as I-EZ (eye ease) are cleanable for repeated re-use, as in the case of earlier Permocharts. The three colors include green, ivory and blue. In addition to making inspection of the chart easier, the colors may be used for identifying different units or operations.

Pyrometer Indicator

UP TO 50 thermocouples can indicate temperatures on a single indicating instrument when using the Micromax Model S indicator, according to the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. This instrument is essentially a Micromax strip-chart indicating recorder, with the recording mechanism omitted. Where the chart would normally be is a panel board containing toggle switches. The operator selects the couple to be used, flips the toggle switch corresponding to it, and reads the temperature which is quickly and automatically indicated on a scale. The switches are of double-throw, non-locking construction with a spring return to neutral. Thus each switch serves for the connection of two thermocouples. Identifying colors for switch handles can be used if desired.

Automatic pulverizer feeder control



Plastic molding press timer

Induction Separator

A RECENT DEVELOPMENT of Magnetic Engineering & Mfg. Co., Clifton, N. J., is the new Type IMR induction type magnetic separator, for which numerous improvements as compared with earlier designs are claimed. This machine consists of a series of revolving laminated rolls, formed of high permeability steel laminated with phosphor-bronze of the same hardness as the steel, to insure even wear. These rolls are magnetized inductively by powerful stationary magnets. The poles of the magnets are in close proximity to the rollers and the magnetic flux converges on the sharp edges of the laminations, producing powerful magnetic fields on the rolls.

Materials to be separated are fed in a thin stream from an automatic hopper to a primary separation stage consisting of one laminated roll and a separate magnet. Non-magnetic material follows its natural trajectory, while magnetic material follows the roll sufficiently to be separated from the non-magnetic material by an adjustable splitter. The non-magnetic material passes through one or more additional separating stages of higher intensity, while the material showing magnetic susceptibility is separately discharged at each stage. Various numbers of stages ranging from two to as many as nine are available, depending on the type of separation.

Improvements include the use of specially designed primary pole points to confine and direct the flux in a narrow band across the roll; a larger magnetic circuit; the use of specially sealed and protected anti-friction roller bearings; rugged construction; and easy visibility of all working parts to permit ready adjustment during operation. The manufacturers claim that this design will separate many materials hitherto considered impossible to separate magnetically. Typical uses include removal of iron oxide from glass sand and abrasives; concentration of ores such as wolframite, rutile, and manganese; removal of stains from salt; purification of nepheline syenite, dolomite, borax and similar materials.

Plastic Press Controller

MODEL A-127 is the designation of a new single-cam cycle controller developed by the Bristol Co., Waterbury, Conn., especially for the automatic timing of plastic molding presses. The timer is said to give accurate results and to be readily adjustable for different schedules of operation. It is arranged to time automatically from one to four separate factors and is adapted for use where such operations follow each other in rapid sequence. The length of the pre-heating, curing and breathing periods can readily be altered by the user without changing cams. Timing of the curing period is taken care of an adjustable timer which can be set for any length of cure by the turning of a knob. The range of this adjustable timer is from zero to 20 minutes. All other operations are timed by a cam, with the preheating and breathing periods determined by the position of two cam segments which can be cut to proper length and positioned on the cam to give the desired schedule.

Pulverizer Feed Control

BY REDESIGN through the substitution of electronic devices for the electrical control previously used, a new version of the Mosher automatic control for mechanical feeders used with pulverizing machines is now available from Max Mosher, 130 West 42d St., New York, and St. Louis, Mo. The new design is considerably simplified and therefore more economical in equipment cost. This control is said to permit mechanical feeding of pulverizing machinery with far greater accuracy and economy than is possible with manual control. Such commonplace troubles as clogging, overheating and motor burnouts, arising from overloading or variations in moisture or material, are avoided, according to the manufacturer.

The equipment consists of a unit housed in a steel case and connected to the magnetic contactor switch of the feeder motor. A special current transformer is provided which is wired into the pulverizer motor circuit and

connected to the control instrument. When first set in use an ammeter is employed to set the instrument for full load current on the grinder motor. This setting is permanent. In operation the grinder motor is started in the regular manner. The feeder motor, being interlocked with the grinder, cannot be started until the latter is in operation. A load range regulator on the control panel can be set for from 50 to 125 percent of the grinder motor full load. If for any reason the load in the mill rises above this setting, the controller automatically cuts off the feeder motor, cutting it on again when the mill has discharged enough to decrease the load. Lights on the control panel indicate the condition of operation.

Vapor Scrubbing System

SHOWN in an accompanying view is a vapor scrubber recently designed by L. O. Koven & Bro., Inc., Jersey City, N. J., for a manufacturer of fine chemicals. The installation, which includes three scrubbing tanks in series connected to a vacuum pump for drawing the vapors in turn through the three tanks, is said to provide for complete absorption of removable contents from vapors given off in a number of processing operations.

Each tank is fitted with a serrated bubbling cone and contains a scrubbing solution. Vapor entering below the surface of the scrubbing solution gives up its removable content and bubbles up past the cone, traveling over into the next tank on its way to the vacuum pump.

Photoelectric Spectrophotometer

NATIONAL TECHNICAL LABORATORIES, 820 Mission St., South Pasadena, Calif., has announced the development of a new photoelectric spectrophotometer designed to be highly versatile and readily adaptable to the varying conditions encountered in both research and control work. The instrument can employ various light sources for different wave lengths, but is ordinarily supplied with a standard 32 c.p. 6-volt tungsten automobile headlight lamp, the rays from which are passed through the lower of two similar slits and fall on a collimating mirror, from which the light is reflected to a quartz prism. The back surface of the prism is aluminized so the light refracted at the first surface is returned along the same path, undergoing further refraction when it emerges from the prism as a parallel beam, which is again reflected from the collimating mirror and focused in a spectrum in the plane of the upper slit.

Light of the wave length for which the prism is set then passes out of the instrument, through an absorption cell, to a phototube. Two phototubes having sensitivities to different portions of the spectral range are provided, either of which can be moved into position for use. Three types of phototubes are available. Output of the phototube can be read by means of one of this company's laboratory pH meters, or by means of a built-in measuring instrument which will soon be available. The instrument is adapted to the use of two, three or four absorption cells, depending on the path length desired, and can be used with special set-ups for thermostatic control, constant flow samples, or titration. A feature of the instrument is the fact that it is self-contained.

Multiple Water Control

FOR THE PURPOSE of maintaining close and proper water levels in two or more boilers, using a single boiler-feed pump, the Johnson Corp., Three Rivers, Mich., has introduced a multiple-boiler water control which operates electrically and automatically. Two stationary electrodes, of different lengths, are mounted in a small holder on each boiler. When the water level in the boiler falls below the longer electrode, an electric curcuit is disturbed which, through a relay, starts the boiler feed pump. At the same time a motor-operated valve is opened to divert the pump discharge into the boiler requiring water. When the water level reaches the desired level the pump stops. If necessary all boilers can be fed simultaneously.

This equipment is suitable for boilers up to 150 lb. pressure and up to 250 hp. capacity. It can be used with any type of steam- or motor-driven feed pump. An auxiliary condensate receiver is installed behind the pump, equipped with another Johnson water level control which automatically adds make-up water to the system as needed.

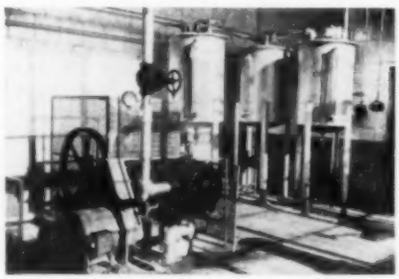
As shown in the illustration, a third electrode can be provided, if desired, to sound an alarm or cut off the burner if the water level should fall to a dangerous point.

Combustion Control

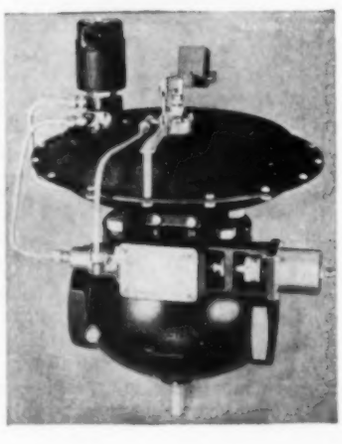
A SIMPLE combustion controller for gas-fired boilers, designed to maintain a constant steam pressure at all times by throttling the gas flow and air damper, has been announced by General Controls Co., Glendale, Calif. Known as Series B-55G, this new diaphragm-operated fuel supply valve is electrically piloted, employing a design said to eliminate the "hunting" common to many throttling valves. An additional feature is the provision of a low-fire adjustment which sets the minimum amount of fuel supplied to the burner.

The valve is built in sizes from 1 to 6 in., for a variety of steam pressures and for gas pressures from 2½ in. w.g. to 5 lb. It has a range of opening speeds adjustable from 20 to 60 sec. The closing time is fixed, regardless of opening adjustment, ranging from 3 to 6 sec. after the electrical contact is broken.

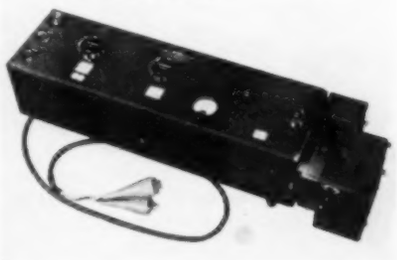
Simple vapor scrubbing system



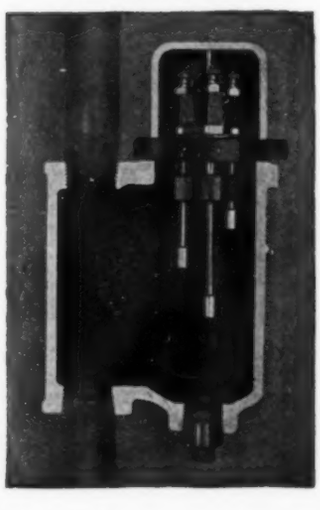
Combustion control valve



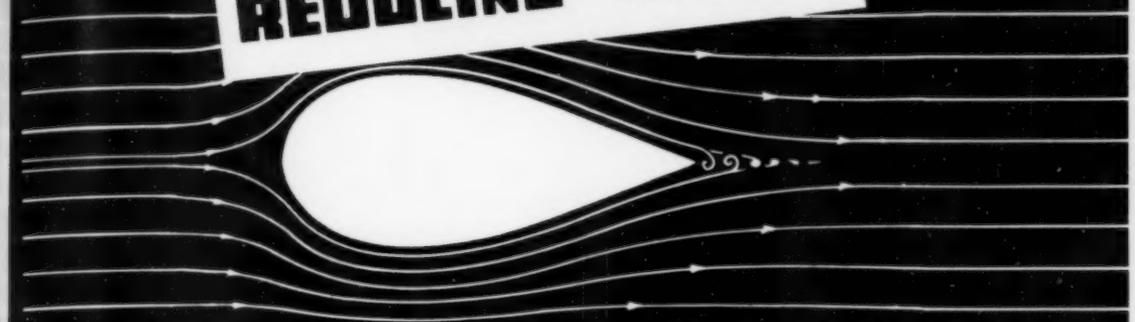
Photoelectric spectrophotometer



Cross section of boiler control electrode unit



CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE



3 IMPORTANT CONSTRUCTION FEATURES THAT GIVE YOU

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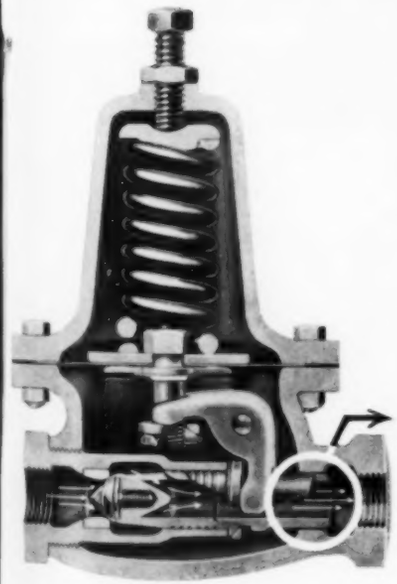

1 Streamlined flow around the inner valve —eliminates turbulence— thereby gives you best control under varying loads.

2 Straight path for the fluid through the *flow tube* — gives you better pressure control and greater capacity.

3 The Aspirator gets the inner valve wide open to meet the demand and hold delivery pressure constant.

The Streamlined Type 1000 is available with inlet pressures to 3000 lbs., delivering vacuum to 125 lbs. Sizes ¼" to 2" screwed ends. There are no complicated parts to get out of order — no small ports or passages to clog up — no close fits. You will get much longer, lower cost service and your attention costs will be down to the absolute minimum. Day after day you will experience smooth operation, accurate regulation, elimination of failures and spoilage — plus all this the Streamliner makes a definite contribution toward speedier production results and ends worry and bother that is ordinarily experienced.

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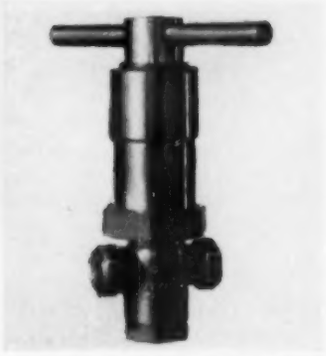
A CASH STANDARD "GET ACQUAINTED" COLUMN

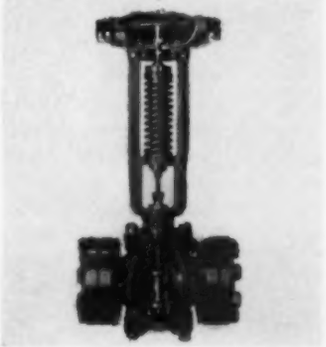
Question: "Don't you people make anything besides that Streamlined Valve you talk about so much?"

Answer: "Yes Sir; we do! And we propose to picture one or two of them here each time."



Cash Standard Type 18245 Reducing Valve handles oil or water under high pressures; maintains constant reduced pressure despite variations at inlet. Bronze body, single seat. Trim is nitralloy or stainless steel. Large T-bar handle adjusts discharge pressure.

Initial pressures to 4000 lbs., reduced pressures 500 to 2500 lbs. Sizes ⅜", ¼", ½", ¾" and 1", all screwed ends.



Cash Standard Type 33 Relief Valve; made with diaphragm or piston action, and of various metals to handle nearly all fluids. As indication of the fine mechanism we point to the roller guides for the valve spindle, and the roller bearing which takes care of spring torsion. Sizes ½" to 3" screwed ends, 1" to 12" flanged ends.

☆

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A. W. CASH COMPANY

CASH STANDARD CONTROLS.. VALVES

Magnesium from Sea Water

IN PRINCIPLE, the recovery of metallic magnesium from raw sea water is comparatively simple. Yet the development of a commercially successful process to utilize such a dilute source of raw material (1 part of Mg in 770 parts of raw ocean water) calls for unusual chemical engineering equipment, methods and control. As developed by The Dow Chemical Co. for use in its new plant at Freeport, Texas, the process consists of the following steps: (1) Precipitation of magnesium hydrate from sea water using milk of lime made from oyster shells. (2) After filtration, the hydrate is converted into magnesium chloride using 10 percent solution of hydrochloric acid. (3) The magnesium chloride solution is concentrated, first in direct-fired evaporators, then on shelf dryers and finally, in a rotary dryer. (4) Flaked magnesium chloride, in practically anhydrous condition, is fed into the cells where it is electrolyzed to produce metallic magnesium of average purity between 99.9 and 99.95 percent, along with byproduct chlorine (which is used to make HCl).

The molten magnesium is dipped from the cells and cast into 18 lb. pigs for ease in handling. In this form it is an exceedingly light (Sp. Gr. 1.74) silver white metal widely used in the magnesium alloys known as Dowmetal and for imparting hardness, strength and fatigue resistance to various aluminum alloys.

Additional chlorine for make-up in the hydrochloric acid process is supplied at Freeport from Dow electrolytic chlorine cells. The dilute caustic soda effluent from these cells is concentrated to saleable grades of liquid, solid and flaked caustic. Natural gas is used throughout the plant for power generation, process heating and as raw material for hydrochloric acid and chlorinated hydrocarbons.

CHEMICAL & METALLURGICAL ENGINEERING

November, 1941

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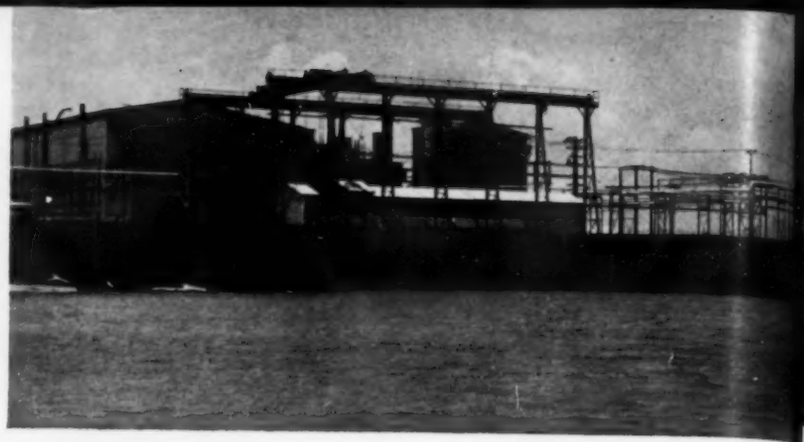
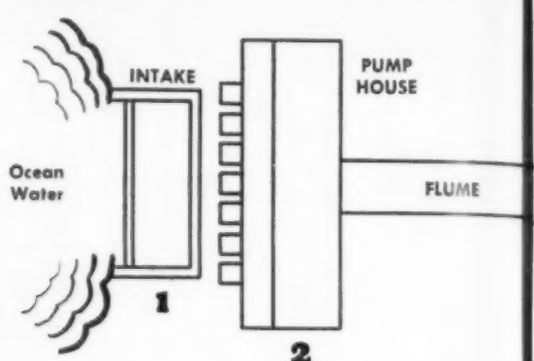
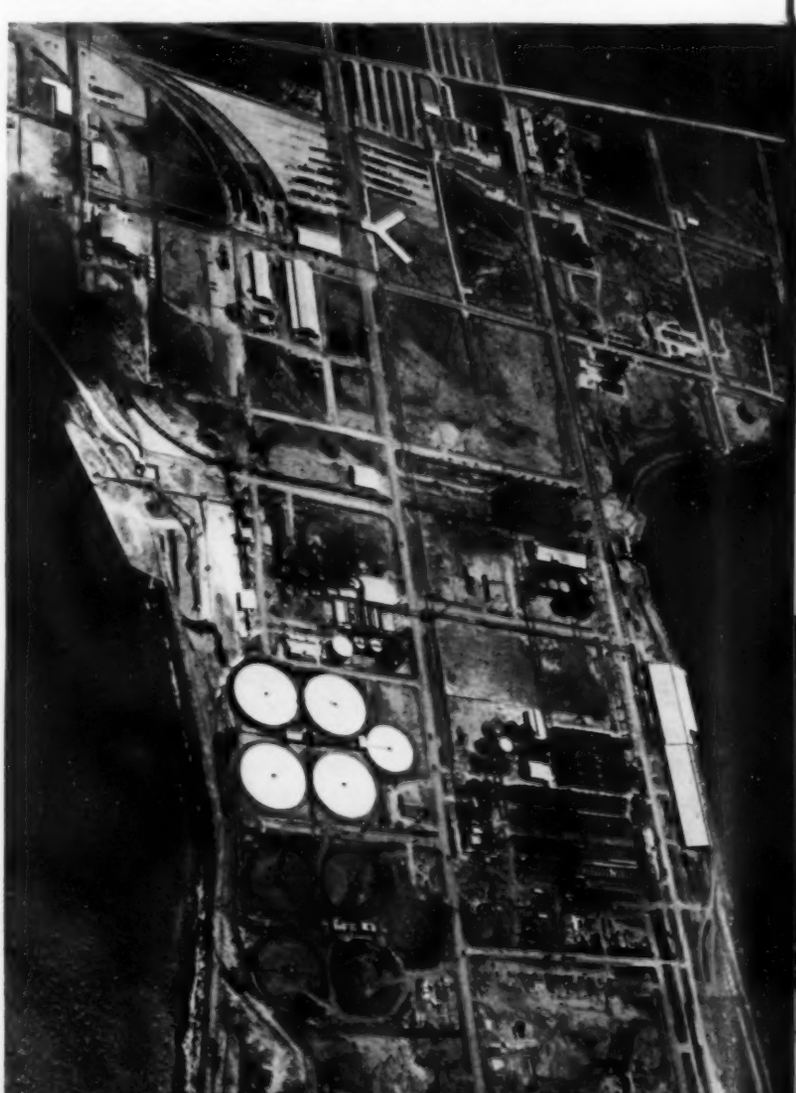


1 Through this intake is daily pumped 300,000,000 gal. of raw ocean water to be processed for magnesium and bromine

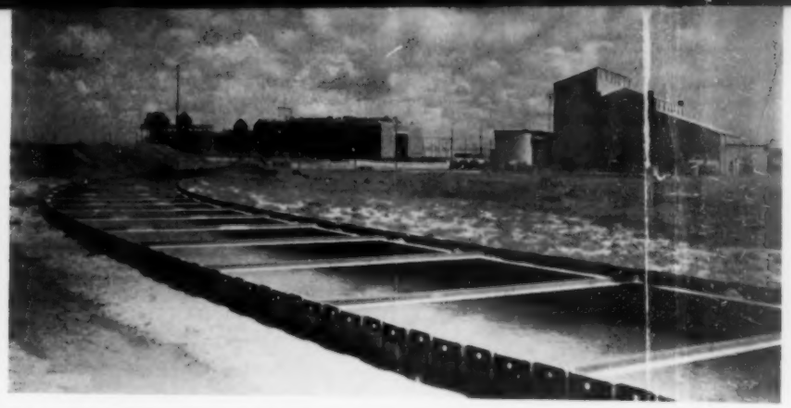
A *Chem & Met* FLOW SHEET



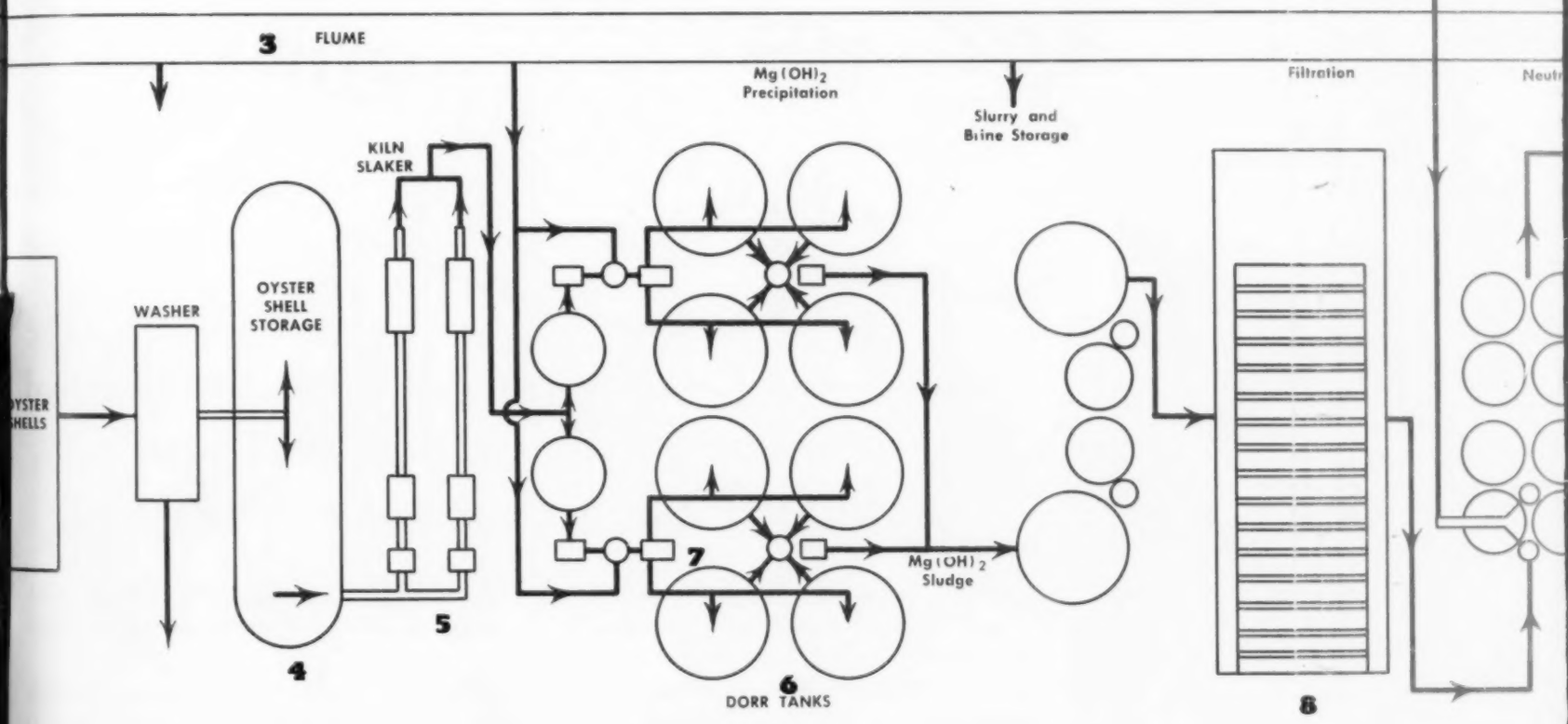
Here 18,000,000 lb. per year of magnesium is now recovered from sea water. Another unit of similar capacity will shortly start production



p house showing the "roller-towel" type of screens used to remove
r trash, refuse and larger marine life from incoming sea water



3 This 10-ft. flume, built of interlocking steel piling, carries raw materials for magnesium operations and bromine plant shown in the distance

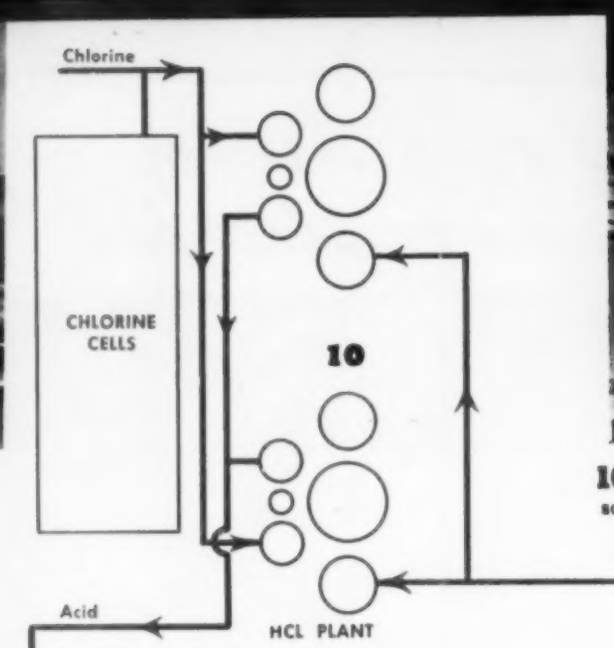


4 Oyster shells dredged from Galveston Bay are washed with sea water and stored in huge piles prior to calcining for producing lime to precipitate Mg(OH)

5 Traylor lime kiln 300 ft. long and 8 ft. in diameter serves the rotary lime slaker which is 7 ft. 9 in. in diameter. Note foundations for

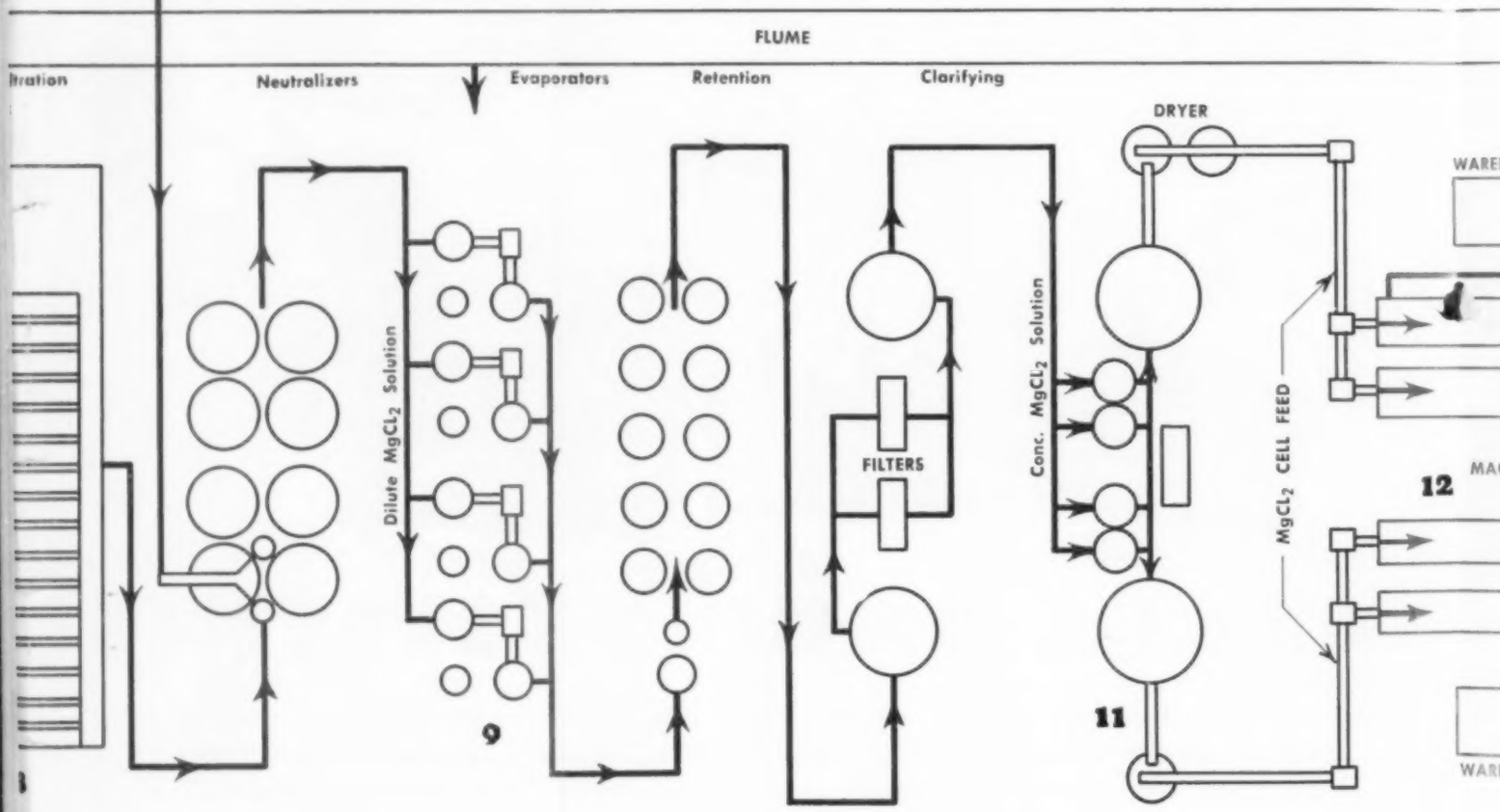
6 Dorr lime clar
200-ft. magnesium

rials for



10 Hydrochloric acid plant with storage tanks at left and scrubber towers in the rear

11 Anhydro
shelf dryer



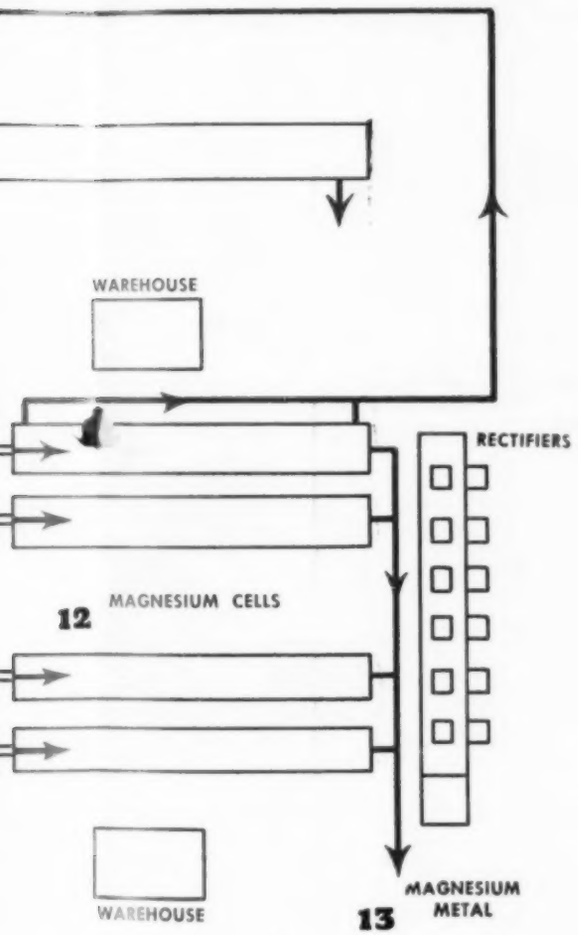
y lime

6 Dorr lime clarifier, 150-ft. in diameter in foreground and four 200-ft. magnesium hydrate thickeners served by central flocculator

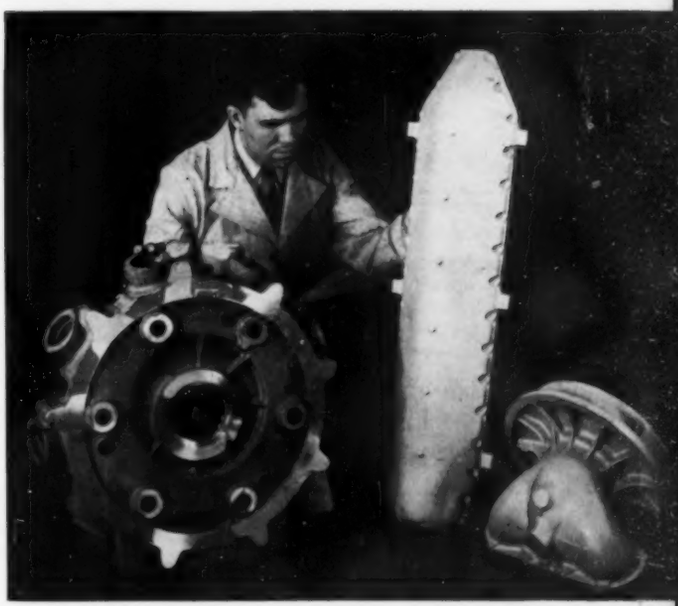
7 Flocculator tank in which lime solution meets and is mixed with

11 Anhydrous magnesium chloride storage bins and conveyors from the shelf dryer barely visible behind the tall building at the right

12 Dipping molten magnesium from one of the many cell pots in electrolysis building

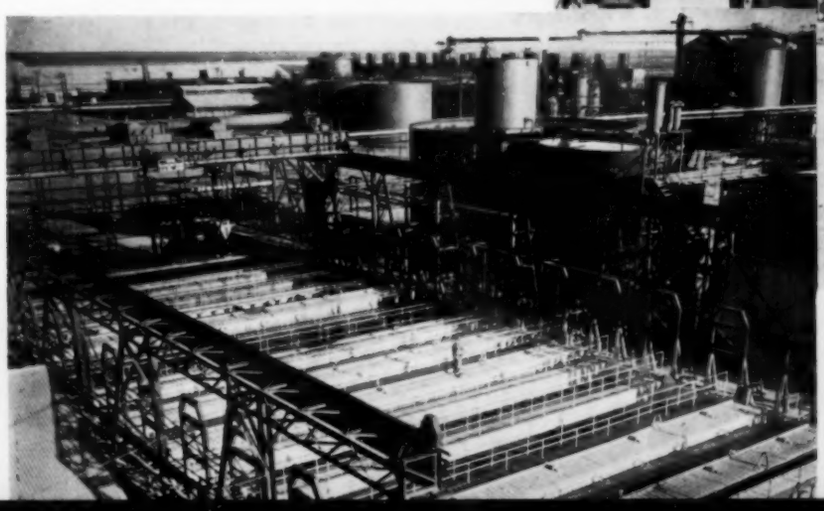


13 Magnesium produced at Freeport is converted elsewhere into alloys for castings and wrought products for aircraft



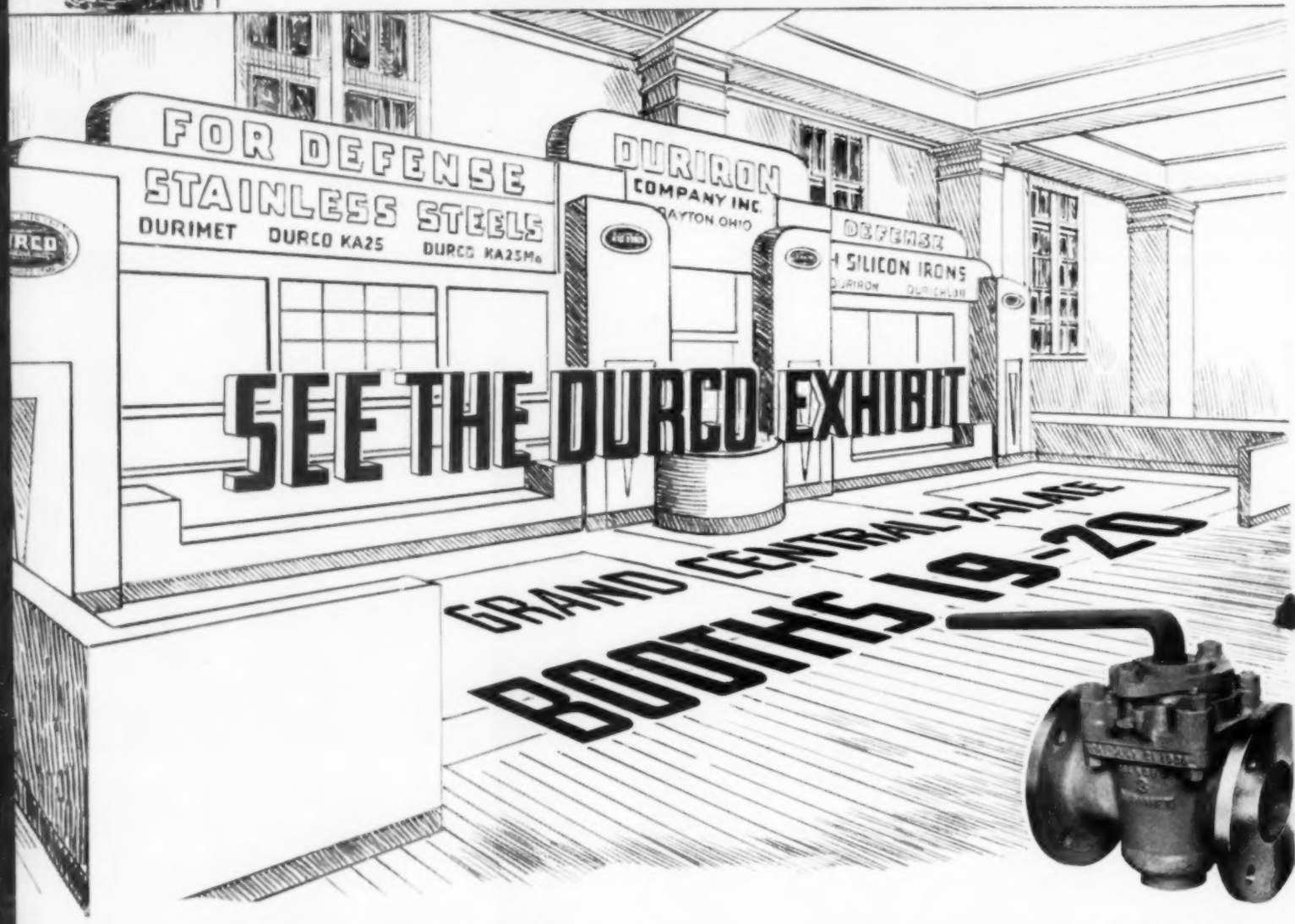
9 Direct fired evaporators for $MgCl_2$ with scrubber towers in foreground

s mixed with



8 Moore type filters adapted for filtering the precipitated floc of magnesium hydrate

STOP . . . Look Ahead



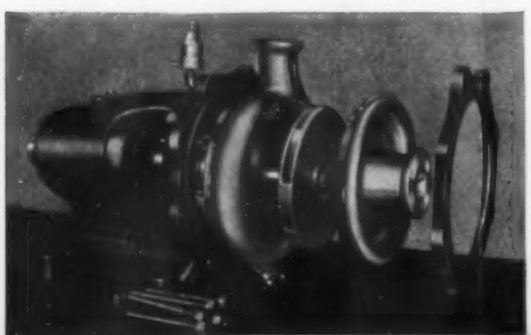
DURIMET-DURIRON Plug Valve —Body of Durimet, Plug of Duriron, to provide larger number of acid-handling applications and longer life.

● An exhibit that will help you in planning for the present . . . in building for the future.

● See the graphic demonstration of the interchangeability of the Model 40 Durcopump . . . see it converted right before your eyes from a Duriron pump to a Stainless Steel pump, or to anyone of ten corrosion-resistant Durco alloys. This is a money-saving feature exclusive with Durcopumps.

● See the new and improved type of Durco plug valve . . . the only valve made with interchangeable body and plug to combine the strength of stainless steel with the resistance to corrosives and abrasives of Duriron . . . a feature that provides wider application and longer life for your acid-handling valves.

● See the new ideas in Duriron tank outlets, steam jets and other standard corrosion-resisting equipment. To be informed on new and improved equipment to handle corrosives, see the Durco Exhibit.



Model 40 Durcopump showing interchangeable parts in color. Volute, impeller and cover may be readily removed and corresponding parts furnished in other corrosion-

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SAFE!
WRONG!
RIGHT!
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
11 SIMPLE WAYS TO GET BETTER SERVICE FROM PIPING EQUIPMENT
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE
INSTALL

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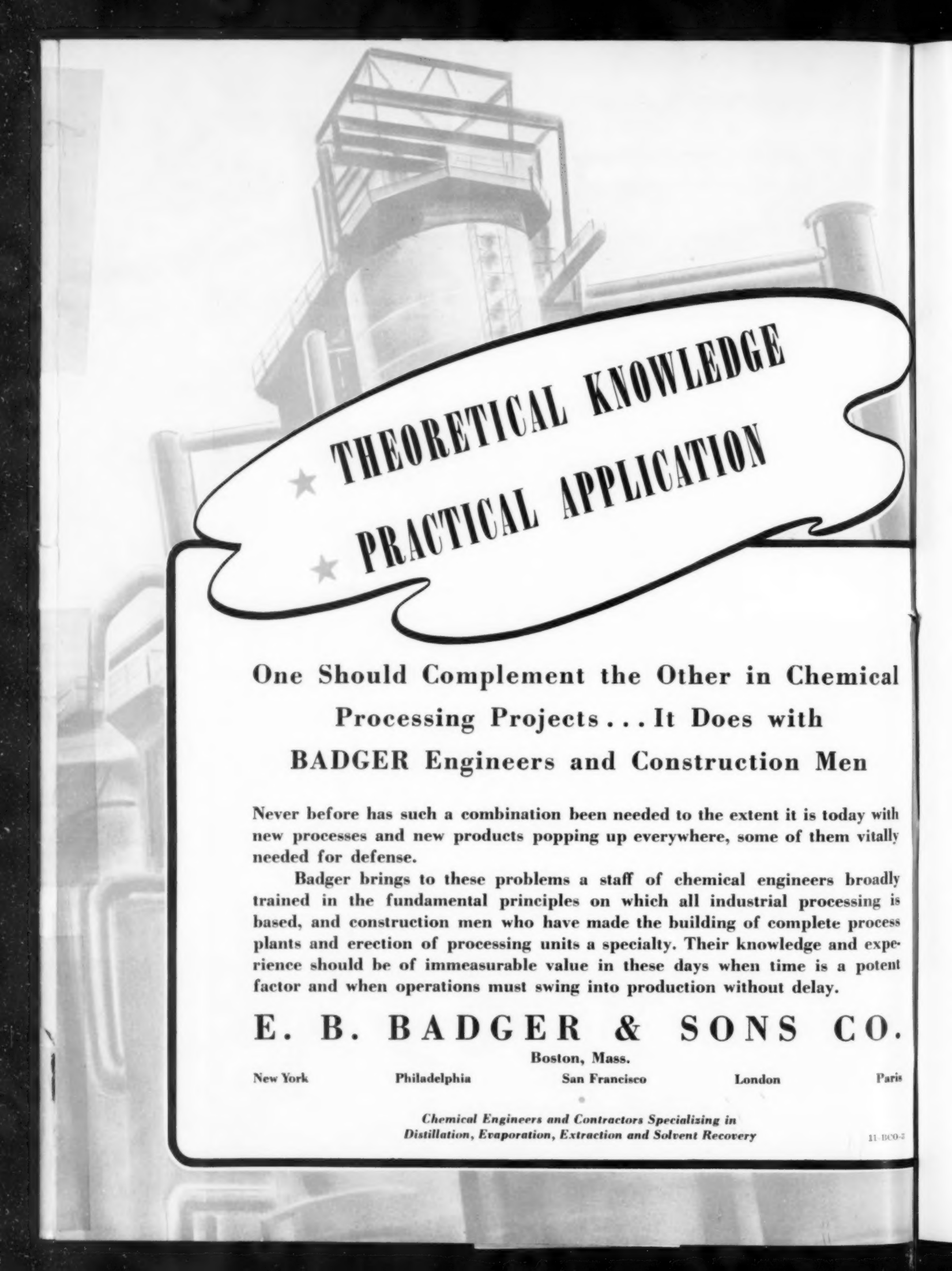

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Technical, Industrial, Personal

F. W. DENNIS HEADS CHEMICAL SECTION OF NSC

At the National Safety Congress and Exposition, held in Chicago, Oct. 6-10, sectional officers for the Council were elected for the ensuing year. Officers for the Chemical Section are F. W. Dennis, Hooker Electrochemical Co., Niagara Falls, general chairman; James J. Duggan, Carbide & Carbon Chemicals Corp., South Charleston, vice-chairman in charge of program; S. W. Gurney, Liberty Mutual Insurance Co., Boston, secretary.

Members of committees include: News Letter—R. C. Stratton, The Travelers Insurance Co., Hartford, chairman, E. F. King, Lever Bros. Co., Cambridge, and W. C. Shaw, Procter & Gamble Defense Corp., Milan, Tenn.; Engineering—H. F. Gilbert, American Cyanamid Co., chairman, and S. E. Whiting, Liberty Mutual Insurance Co., Boston; Data Sheet—R. O. Keefer, Aluminum Co. of America, Pittsburgh, chairman, John W. Sawyer, Procter & Gamble Co., Ivorydale, and A. L. Watson, Koppers Co., Pittsburgh; Health—Dr. Leonard Greenburg, N. Y. State Department of Labor, New York, chairman, S. M. McCutcheon, The Dow Chemical Co., Midland, and John S. Shaw, Hercules Powder Co., Wilmington; Membership—C. E. Sevrens, Monsanto Chemical Co., Boston, chairman, W. L. Hammersley, Electric Storage Battery Co., Philadelphia, and James H. Hayes, National Fireworks Inc., West Hanover, Mass.; Poster—H. R. Bixler, Union Carbide & Carbon Corp., New York, chairman, and Ralph L. Rogers, Tennessee Eastman Corp., Kingsport; Publicity—S. D. Kirkpatrick, *Chem. & Met.*, New York, chairman, and V. K. Anderson, Agfa Ansco Corp., Binghamton; Safety Instruction Card—R. S. Mackie, General Electric Co., Cleveland, chairman, R. C. Hamilton, The Solvay Process Co., Syracuse, and John Roach, Deputy Commissioner of Labor, Trenton; Statistics and Contest—Allen L. Cobb, Eastman Kodak Co., Rochester, chairman, H. L. Miner, E. I. du Pont de Nemours & Co., Wilmington, and B. H. Schenk, The Visking Corp., Chicago.

ALUMINUM CO. RESIGNS RIGHTS TO "ALCLAD" TRADEMARK

In the interest of the National Defense Program, Aluminum Co. of America last month announced that it is giving up its exclusive rights to its registered trademark "Alclad." This trademark, under which certain "duplex" aluminum materials broadly used in the aircraft and other defense industries have been sold for 14 years, is well known by aircraft, military, and naval designers.

The unique method of making the coating an integral part of the core was invented by Aluminum Co. of America, and the trademark "Alclad" was registered in 1927 to apply to all the company's duplex products. Ready adoption of Alclad materials quickly established the trademark in the minds of the aircraft and other industries, as well as among United States Army and Navy engineers. Other aluminum producers are now making similar duplex materials ultimately destined for government use, and Aluminum Co. recognizes the fact that the name "Alclad" is a convenient means of identifying such material as produced by others as well as its own products.

OIL CHEMISTS TOLD SOURCES OF UNUSED VEGETABLE OILS

Unused sources of vegetable oils which might have future commercial value were cited by E. B. Kester, Western Regional Research Laboratory, Albany, Calif., in a paper read before the fall meeting of the American Oil Chemists' Society at Drake Hotel, Chicago, Ill., Oct. 8-11.

These lesser known and little used vegetable oils are at present largely waste products of crops grown on a large scale. They fall under the three classifications of pit, seed, and seed-covering oils.

OPM AND OPA OFFICIALS WILL SPEAK AT CHEMICAL SHOW

On Wednesday, Dec. 3, at 9:00 A.M., a special meeting will be held at the Exposition of Chemical Industries in Grand Central Palace to which the exhibitors and other manufacturers will be invited to discuss various details of the OPM and OPA which interest them.

Speakers will be: Dr. E. W. Reid of the OPM Chemical Section, Stanley Oppenheim of the Priorities Division, and Joel Dean of the Industrial and Agricultural Machinery Division of the Office of Price Administration. The latter will discuss price ceilings of machinery and Dr. Reid will discuss chemicals, while Mr. Oppenheim will discuss general priorities.

ETHYL GASOLINE CORP. WILL BUILD ACID PLANT

Expansion of the Ethyl Gasoline Corp. plants at North Baton Rouge at a cost of $2,500,000, and the adoption of new production methods will make possible the substitution of hydrochloric acid for chlorine in the manufacture of tetraethyl lead, thus freeing Ethyl's chlorine production for defense needs.

Present chlorine plant, operated for the corporation by the R&H Chemicals Department of E. I. du Pont de Nemours & Co., is the largest in the United States for electrolysis of fused salt, excepting only the R&H plant at Niagara Falls, N. Y. Although running at capacity since chlorine shortages first developed, the lack of liquefaction machinery now permits only a fraction of daily production to be used. Machinery to liquefy all chlorine produced will be installed on rush orders, to be completed by the time the hydrochloric acid plant is ready to supply needs of tetraethyl lead manufacture. The capacity of the chlorine plant will be increased by the addition of a new wing, also expected to go into operation next Spring.

ABBOTT LABORATORIES GRANTS FELLOWSHIPS

For the academic year 1941-1942 Abbott Laboratories has established fellowships in several universities with important departments of organic chemistry and biochemistry. The fellowships, carrying stipends of $650, have been made available to graduate students in the last year and next to last years of graduate work leading to the doctor's degree. The recipients have been selected by the universities in which their work is being done, and they are not limited by the fellowships as to the subjects of their investigation.

Grants have been made to the following universities: In organic chemistry: Illinois, Michigan, Ohio State, Pennsylvania State, Purdue; In biochemistry: Columbia, Cornell.

MONSANTO WINS PATENT ON MELAMINE RESINS

After an extended priority controversy in the Patent Office involving the Ciba Products Corp. and American Cyanamid Co., Monsanto Chemical Co. was finally awarded the basic patent on melamine resins. The patent, number 2,260,239, was issued on October 21, 1941.

Inasmuch as important subsidiary patents relating to the melamine resins field have been granted in this country to Cyanamid, as well as Ciba interests, arrangements have been concluded whereby licenses granted by the owners of these subsidiary patents will include rights to operate under the basic Monsanto patent.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

FULL war status is now expected in industry. Washington does not assume that a war declaration is necessary before it can demand extreme emergency methods from business. Members of Congress who shout loudly for the rights of the Congress to declare war are actually glad that they do not have to cast a vote on that question. They are content to let the President carry on with the country fully involved in every way except offense trigger pulling.

A very important policy decision was reached in Washington some weeks, possibly months, ago. This decision was that the United States would make 100 percent war effort now. The hope was to finish the job of beating Hitler in two years. The alternative was a ten-year program, which is quite a different thing. Apparently the tacticians and government executives decided that a tremendous immediate sacrifice by all would be more promising than a long steady pull of less intensive nature. The decision was for the short "all out" effort.

Under these circumstances engineers and executives of chemical process industry will make no mistake in making their decisions on the assumption that we are for all practical purposes already at war.

Copper Allocation

One of the most drastic administrative orders ever issued in Washington was the OPM copper order published October 22. It sets up such drastic restrictions by allocation as virtually to doom many small units of business. Such an extreme action would probably not have been taken if Washington had not previously decided as a matter of policy that the United States should proceed immediately as if actually engaged in a declared war.

This order is important to every element of business, whether interested in copper or not. It sets the pattern of policy procedure which has been adopted by SPAB. In effect the order does three distinct things:

1. It provides for immediate conservation of copper by limiting uses in many types of manufacture on the basis of a fixed percentage of the consumption in 1940.

2. It prohibits *any* use of copper after certain dates for certain purposes.

3. It sets up an allocation plan to insure delivery of copper to those most urgent defense uses for which the supply is being conserved.

Chemical process industry needing copper for certain equipment purposes will be supplied if the application is a matter of urgency for defense. But about 25 percent of the "requirements" for copper in 1942 will not be met since the supply to be expected does not exceed three-fourths of the important wants of the country. Obviously the less essential civilian uses must be cut off altogether.

The allocation program differs fundamentally from previous priority actions in giving orders to the producers or importers as to where they ship their output. A man who previously had a priority gets some favorable attention, but a priority is no longer good except for prestige when he applies for allocations.

Priorities will be continued for most commodities where the shortages represent a nominal percentage of total use. But other commodities for which large deficiencies are expected will gradually be put on allocation programs like that established for copper. It is some comfort for industry to know that government procurement officers will be regulated just as fully and rigidly in their requests for supplies as are private purchasers.

Ammonia Shortage

During October final arrangements in tentative form were perfected to complete the ammonia programs previously announced. Not all the contracts have been negotiated, but tentative selection of contracting and constructing companies had been determined well before the end of October for the last 500 tons per day of ammonia capacity needed to finish the explosives program to serve four million men in the field.

Despite the completion of this military program, there will be shortages of ammonia next spring. These promise to be very serious for some. The fertilizer industry will suffer the greatest shortage, but there are some compensating and alleviating considerations.

The fertilizer industry will have finished manufacture of most supplies of materials needed for the 1942 crop-growing season before the ammonia shortage hits the industry seriously. But some time next spring it is expected that there will begin serious difficulty in getting "ammonia solution" for ammoniation of superphosphate. At that stage the explosives makers will begin to take so much ammonia that there will be too little left for shipment as anhydrous, liquor, in urea mixtures, or in other form to be used in quick cure super making. Some adaptation of acidulating plant methods must then be made. Some plants probably will return to the old slow den-cure technics.

The industry and agriculture have been promised that there will be ships enough to bring all needed Chilean nitrate to the United States for next year's crop use. If the Maritime Commission makes good on this promise there will be some shifting from ammonia fertilizer to nitrate fertilizer materials. That shift may be much greater for later seasons. Where no other nitrogen fertilizers can be supplied, the farmers will be urged to use more legume crops.

More Complete Controls

Under the wartime program there will rapidly develop more complete controls of many sorts. The pressure of taxes will be constantly greater. Regulation of many types of private enterprise must be undertaken.

The labor situation is not going to be as bad as was anticipated some months ago, in some ways. A shortage is expected in certain types of skilled labor next spring, but this shortage promises to press on process industry rather lightly because it will be able to pick up many workers forced out of normal employment by closing of plants which cannot get normal raw materials, usually metals. The shortage anticipated therefore promises to be primarily in skilled supervisors and experienced foremen. Washington is therefore urging all industry executives to do more employee training, particularly upgrading of junior workers.

Since the chemical process industries are generally makers of industrial materials, rather than finished products, they will suffer under the allocation and priority program of the future more as this affects their equipment problems than as it affects their raw materials. Furthermore, process industry executives are being urged by some to plan to convert their sales staffs into allocation and distribution experts. Such men are going to be needed for the study of customer problems. Only by intelligent cooperation of sales organizations with user groups will it be possible for the producers of chemicals and other industrial materials to advise with the government most effectively as to the course of new distribution plans. It might be said that the sales force which knows most about its customers' real needs will be the one that will serve them best in the next year or two.

Price controls are coming slowly. Washington does not now expect that the President will be granted authority to fix prices until some time in late January or February. By then there will be many more price spirals well out of hand. The difficulties of any effective administration will, therefore, be greater than if soon established. This fact is admitted, but it does not persuade Congress to vote effective legislation now.

Munitions Plants

New Army munitions plant activities during the month were confined almost entirely to selection of a half-dozen sites for additional factories.

The first plant designed specifically for manufacture and assembly of incendiary bombs will be constructed near Pine Bluff, Ark., and operated by Chemical Warfare Service. The plant will specialize in magnesium and thermite bombs and the output is expected

to be largely shipped abroad under lend-lease. A total of one million square feet of floor space is involved and operations will require 2,000 employees. Production capacity is not announced, for military reasons.

Parts of the third government ammonia program previously discussed in these columns began unfolding during the month. The Army announced that a big ammonia plant will be built at South Point, O., and that an ammonia and ammonium nitrate works will be constructed at El Dorado, Ark. Size of neither establishment has been announced but they are both expected to be in the same production range as previously announced similar plants to produce these commodities.

Another TNT plant, using toluene as a base, will be located at Brownsville, Pa., employing 2,000 men on a round-the-clock basis. A fifth new plant announced is a bomb loading assembly at Wahoo, Neb.

Except for the chemical shell works, these plants all will be government-owned and operated by private management not yet finally selected.

Harris & Ewing

Donald Nelson with Chairman Paul Wooton at recent dinner of American Business Paper editors

Alcohol and Solvents

To get alcohol from whiskey distilleries requires either modified practice or modified regulations. Simultaneous operation with two types of products is not permissible under old rules. Thus, Manufacturing Chemists Association has been backing the Gearhart bill which would further the national defense supply of alcohol without breakdown of necessary regulatory measures.

There has been much confusion regarding the alcohol and molasses situation. The shortage has been primarily in boats rather than in either the molasses raw material or the alcohol capacity of eastern states plants. Nevertheless, the continued uptrend in alcohol making threatens to create a shortage of molasses. And unless some speed-up in sugar growing occurs, there may be a sugar shortage also when Uncle Sam and his island neighbors take over the job of feeding much of the rest of the world.

Confusion on methanol matters also plagued Washington for a time. But OPA took drastic steps to curb the price of alcohol from wood. In doing so it criticized sharply the wood distillers but strongly complimented synthetic methanol makers for maintaining or even cutting prices during periods of shortage.

Much more complete regulation of all these alcohols and related commodities is expected. A glycerine price ceiling has been fixed. Complete regulation of chlorinated hydrocarbon solvents was set up.

Normal butyl alcohol price schedule was promulgated and dozens of other comparable actions taken. Gradually the shortages are forcing these regulations. This is partly to protect customers, but is almost equally to protect honest makers and distributors whose fair practices are in striking contrast with the actions of some irresponsible newcomers.

Chemical Miscellany

Plenty of Fertilizer—Critical study of phosphate rock, potash, sulfuric acid, and other raw material problems indicates no prospect of shortage for at least at year. Ammonia shortage is expected (see item above). One of the great worries of industry executives and engineers is, therefore, whether adequate freight car and tank car service can be expected. Without that transportation may be serious.

Priority Penalties—The first serious priority crackdown was made in October, against a Chicago aluminum castings company. That firm is to be deprived of its raw material in punishment for shipping which is alleged to have been contrary to official orders. Previously price penalties have been imposed by requiring violators of price ceilings to refund large sums to their customers. But this more drastic priority penalty practically closes down much of the offending company.

Fewer Glass Containers—The Department of Commerce is trying to simplify radically the manufacture of glass containers by securing fewer sizes, shapes, and capacities. It is not too clear how the trade value of a distinctive container may be protected under this program. It appears, therefore, that the industry will have to fight for usual practices vigorously by showing how varied containers can be made efficiently without cutting production capacity of machinery or wasting scarce materials.

Ammonia Program

Name of Ordnance Works	Location and Operator	Capacity (tons/day)	Constructor	Cost (Millions)
Privately Owned:				
.....	Hopewell, Va. Allied.....	?	.....	....
.....	Belle, W. Va. Dupont.....	?	.....	.....
.....	Elsewhere.....	?	.....	.....
	Total.....	1500		
Government Financed:				
Morgantown	Morgantown, W. Va. Dupont.....	250	Dupont.....	$15.0
Ohio River....	West Henderson, Ky. Solvay Process Co.[1].....	150	Atmospheric Nitrogen Co.[1]..	13.6
.....	Muscle Shoals, Ala.[2] T.V.A.....	150	T.V.A.....	6.5
Morgantown (expansion)	Morgantown. W. Va. Dupont.....	200	Dupont.....	18.5
Dixie.....	Monroe (Sterlington). La. Commercial Solvents Co..	150	M. W. Kellogg Co.....	15.8
Missouri.....	Louisiana, Mo. Hercules.....	150	Bechtel-McCone-Parsons....	16.1
Jayhawk....	Baxter Springs, Kans.[3] Military Chem. Wks.[4]....	150	Chemical Const. Co.[5].....	16.7
Ozark.....	El Dorado, Ark.[6] Lion Oil Refining Co.[7]....	150	?	?
Buckeye.....	South Point, Ohio ?	150	?	?

[1] Subsidiary of Allied Chemical & Dye Co.
[2] To make NH_3 and convert all to NH_4NO_3
[3] To make NH_3 and convert approx. 100 tons/day to NH_4NO_3
[4] Subsidiary of Pittsburg & Midway Coal Mining Co.
[5] Also Freeto Const. Co. and F. H. McGraw & Co.
[6] To make NH_3 and convert — tons/day to NH_4NO_3
[7] Negotiations incomplete; contract not yet announced.

DR. HANSGIRG GIVES TALK ON HIS MAGNESIUM PROCESS

Dr. Fritz J. Hansgirg, who developed the electrothermic reduction process for production of metallic magnesium from the oxide, addressed the San Francisco Electric Club, Oct. 20, on this topic—describing the pioneer plants in Austria and Japan, and in detail the Permanente (Central California) plant now being operated by the Chemical Engineering Division of the Todd-California Shipbuilding Corp., another project of the West's legendary Henry J. Kaiser.

Dr. Hansgirg outlined the engineering theory and progress at Permanente with the aid of slide drawings and photographs (see *Chem & Met.* Sept., 1941, p. 9-91 for full description of process employed) and closed his remarks with a reference to the two accidents at Permanente which followed close one upon the other, Oct. 18 and 20. The accident on Oct. 18, in which one man was killed and nine injured, occurred when a spark from welding operations ignited gas flowing through a pipe on a platform 95 ft. above the ground. On the 20th, two welders buffing off some work in a manhole struck some sparks from a grinder onto an accumulation of magnesium dust, it is believed, and the resulting flash badly burned the two men.

To overcome certain difficulties encountered in tableting the dust from the primary retort, Dr. Hansgirg has returned to the process he used originally in Konan whereby the dust is first mixed with hydrocarbon oils to form a paste. This paste is charged directly to the finishing retorts, which are heated first to drive off the hydrocarbons and then the temperature is raised to distill the magnesium metal. This step reduces the operating capacity but will be obviated later when special gas-fired furnaces are installed for distilling off the hydrocarbons. Spectrographic analyses of the magnesium made at Permanente show a purity of 99.9976.

Dr. Hansgirg said that in a new plant, employing a new technic, all the operating force were learning a new type of procedure—and that the process was fundamentally no more hazardous than an oil plant or similar unit. When the educational angle is overcome, the prospects of further accidents will be well overcome, concluded the speaker.

CHEMICAL PERSONNEL CHANGES IN DEFENSE ORGANIZATIONS

Clarence W. Farrier is the new chief of the OPA chemical section. Mr. Farrier has been with the Division of Defense Housing Coordination since the beginning of the year. Prior to that time he had been coordinator for NBC television and Tennesee Valley Authority. Mr. Farrier is a 1916 graduate of Armour in architecture.

In the coal-tar chemicals unit of OPA, Hibben Ziesing is now chief. To Robert P. Wight in fine chemicals and Bernard David with inorganic acids, both units of OPA, our apologies for misspelling their names last month (*Chem. and Met.*, October 1941, page 113).

New on the staff of the OPM chemical branch is H. H. Meyers, formerly of Virginia-Carolina Corp., who will be in the nitrogen unit. Felix Stapleton now has the heavy chemicals unit of the branch.

Consolidation of Civilian Supply chemical section, under Lawrence Brown, within the chemical branch of OPM is anticipated at the end of October and may take place at any time.

Wide World Photos, Inc.

Pictured while on a tour of the Permanente magnesium plant, left to right: Dr. Fritz Hansgirg, Henry J. Kaiser, and Sidney Hillman

AMERICAN GAS ASSOCIATION HOLDS ANNUAL CONVENTION

Over 2,000 members of American Gas Association participated in a series of convention meetings at Atlantic City October 20–22. This convention was abbreviated, and was held without the customary big exhibit of equipment, supplies, and appliances. All this was in keeping with the desire of the membership to get the maximum of technical benefit in a minimum of time away from their important home duties.

In general, the reports to this convention were encouraging. But it was notable that the representatives of some of the largest holding company groups in the country were not present because their parent companies have withdrawn from membership in A.G.A. This fact caused much corridor comment and some leadership gloom. It is the result of the feeling that under present S.E.C. and Federal Power Commission actions, the parent utility holding companies cannot wisely participate in this sort of association activity. It is rumored that other important holding companies will follow the lead in this matter of People's Gas Light and Coke Co. of Chicago and Consolidated Edison Co. of New York.

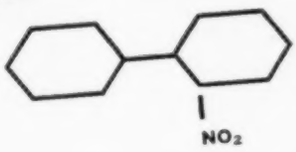
Outstanding at several points in the program were reports on methods for protecting utility gas systems against wartime damage. The convention had the benefit of first-hand reports by several engineers who had spent considerable time in England. The technics developed in London were particularly informative, both those which prevent damage to vital equipment by proper protective walls and those methods which must be used after bombing causes a break in distributing systems.

The Technical Section, which deals with most of the problems of interest to chemical engineers will during the next year be headed by Mr. Harold L. Gaidry of New Orleans. The new vice-chairman of the section is Mr. John H. Wolfe of Baltimore. Mr. A. Gordon King continues to be the headquarters representative and secretary of the technical section.

MONSANTO OPENS LABORATORY FOR RESEARCH IN BAKING

Opening of a newly constructed baking laboratory has been announced by Dr. R. L. Jenkins, director of research, Phosphate Division, Monsanto Chemical Co. The new laboratory, under the direction of H. V. Moss and the supervision of Miss Elizabeth McKim, head of Monsanto's baking chemistry, is devoted to research and technical service on products used in home and commercial baking.

The new baking laboratory is part of a construction program now being carried out at the Carondelet, Miss., plant of Monsanto's Phosphate Division.



Molecular Weight: 199

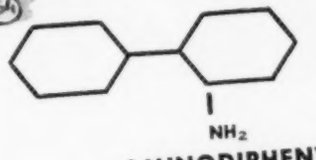
o-NITRODIPHENYL
(Technical)

Appearance: Light yellow to reddish crystalline solid

Crystallizing Point: 34.5°C. Min.

SUGGESTED USES:

Intermediate in chemical synthesis. May be partially reduced and rearranged to give 2, 2'-diphenyl benzidine (NH_2=1).



Molecular Weight: 169

o-AMINODIPHENYL
(Technical)
(Phenyl Aniline)

Appearance: Purplish crystalline mass.

Crystallizing Point: 47.0°C. Min.

SUGGESTED USES:

1. In resin compositions.

2. In dyestuff synthesis to produce dyestuffs of quinoline yellow series characterized by their fastness and a shade of yellow having a green tone. (U. S. Patent 2,211,662).

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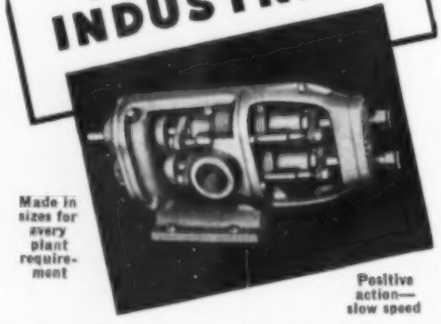

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RESTRICTED USE OF CHEMICALS FOR CIVILIAN GOODS EFFECTS ECONOMIES IN BRITISH PRODUCTION

Special Correspondence

DELIVERIES against contracts account for the bulk of present business in the British chemical markets, but there is no want of new orders at firm prices. The position is perhaps now more balanced than it has been for some time. With the exception of a few products like sodium chlorate, bichromate of ammonia, borax, yellow prussiate of sodium, and permanganate of potash, supplies of industrial chemicals come near to consumers' controlled requirements.

In the import trade fertilizers have recently assumed importance. The "grow more food" campaign necessitates larger consumption of all chemical fertilizers, also of potash and phosphatic manure supplies of which have to be largely imported. Owing to prebuying in August and September winter needs have been largely covered. Authorities now permit purchase of potash for use on sugar, root and vegetable crops in addition to potatoes, onions, carrots, flax and tomatoes to which potash fertilizers were at first restricted. As far as phosphatic manure is concerned, great hopes are entertained with regard to supplies from America. Next year as much as 150,000 tons of American superphosphates are to be distributed to British farmers.

Demand for coal-tar products is still increasing. Light grades of creosote oil and crude naphthalene (which is now available for essential purposes only) are in short supply, and spot parcels of cresylic acid are also difficult to obtain. Nevertheless considerable progress has been made since the Coal-Tar Control was established. The British coal-tar industry was expanding before the war and this movement has continued since with so good results that the output of anthracene, for instance, is now two and one-half times what it was in peacetime, and when present extensions have been completed it will have risen to four times the pre-war level.

Similar increases have been noted in the production of other coal-tar products, but the special merit of the Controller lies in the elimination of difficulties which arose from the wide dispersion of British coal centers. Close technical collaboration has solved many problems, so that entirely new productions have been started. In the field of coal-tar dyes it is hoped that the intermediates industry developed during the past two years will prove its sound basis also after the war. Present costs, it would appear, are not always sufficiently low to permit successful competition with pre-war imports were these now available.

The limitation of civilian consumption of chemicals is still one of the chief tasks facing the authorities, though no outstanding new development has taken place recently. At the end of November the first quota period under the Limitation of Supplies Order is due to expire, and it is quite possible that the screw will then be tightened. At present wholesalers and manufacturers of perfumery and toilet preparations may not supply more than 25 percent of their pre-war sales to retailers.

There are many other restrictions on the use of chemical materials, and it would seem that the tendency is towards qualitative rather than quantitative restrictions. Distribution or allocation of products in short supply by central government agencies, reservation of special materials for certain purposes, preparation of new standard specifications, addenda to the British pharmacopoeia and other wartime adjustments, savings by such means as lighter shades of postage stamps and part-substitution of imported materials, and banning of luxuries and semi-luxuries have proved effective means of reducing consumption without any of the detrimental effects of quantitative and "unselective" shortening of supplies. Manufacturers prefer them because they remove the necessity of differentiating between different customers.

The following are a few illustrations of economies which have been suggested by chemical manufacturers for industrial consuming chemical products:

Textile finishers may save as much as 50 percent of their normal consumption of starch if they introduce small amounts of certain selected wetting and dispersing agents into starch liquors; 10 percent of an alkylated naphthalene sulfonic acid derivative give good results.

Sodium phosphate used in feed-water conditioning after lime-soda softening may be saved by tightening of control during softening. The lowering of the hardness of a treated water by only 0.1 g.p.g. will save 6 oz. of crystalline trisodium phosphate, and more can be saved if the usual reserve of phosphate in the boiler water is reduced as it can be under strict supervision.

Pure blanc fixe can be saved if a mixture of 70 percent of precipitated barium sulphate and 30 percent of precipitated calcium carbonate, produced by simultaneous precipitation, is used instead. This color is slightly yellower than lithopone, but it has been readily accepted for various purposes which include reduction of the high-strength oxides of titanium, zinc and antimony.

A branch of chemical production which has been helped forward by wartime developments is that concerned with materials increasing strength and resistance of textiles. Again a few examples must suffice to show the trend:

Abrasive resistance of overalls, sheet-

ings, etc. is increased by application to the fabrics of 5 percent alkali soluble ethers. These are claimed to lengthen the life of the cloths materially.

Mixtures of thermoplastic resins applied from an aqueous ammoniacal liquor or given together with a fatty alcohol softening agent are used to give rigidity and "fullness" to cellulose fibres of the "worsted-flannel type" which are now finding increased use as a substitute for woollen flannels. Appearance and draping properties are said to be vastly improved by this finishing process.

For a very attractive finish for lisle hose, now largely worn instead of silk hose, application of 0.5 percent of a special thermoplastic resin, either alone or in conjunction with a sulphonated fatty alcohol softener, is recommended, though it is admitted that this finish is not as durable as might be wished.

The production of glass-like plastics has suffered for a long time in Great Britain from the shortage of suitable raw materials, but it is now reported that the output of one of these products, which is water white and glass clear, is running into tons each week. Among articles which are made from the material are coil formers, insulation accessories for high frequency work, buckles and ornaments, and more recently special attention has been paid to its use in lacquers in electrical insulation work, as well as for the impregnation of paper and wood.

A "glassy fabric" which also seems to belong to the family of the synthetic resins has been tried out in aircraft production for covering the wings of small and sports aeroplanes. It is stated to be so fire-resisting that a blow-lamp produces only a slight smudge. Moreover it is claimed not to shrink or stretch from moisture and to be rot-proof besides being both stronger and lighter than standard cotton cloth.

CASEIN FIBER NOW AVAILABLE TO TEXTILE MILLS

After four years of experimental work, the National Dairy Products Corp. has announced successful processing of a new textile fiber. The fiber is known as "Aralac" and is produced from casein. It was developed by the corporation's research division, Atlantic Research Associates, Inc., at Newtonville, Mass. The fiber is now made at Taftville, Conn., by Aralac, Inc., a special manufacturing division of National Dairy. Current production is about 5,000,000 lb. a year and the factory has been operating on a 24-hour basis for the last four months, following more than two year's pilot work at Bristol, R. I.

The felt hat industry was the first to use the fiber where it was substituted for foreign rabbit and hare fur, imports of which were curtailed. Processing changes were necessary before a material for textile mills was evolved but the new fiber is now being used in the manufacture of various kinds of fabrics.

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SCARCITY OF MATERIALS HAS STIMULATED RESEARCH IN ALL BRANCHES OF THE GERMAN GLASS INDUSTRY

Special Correspondence

GLASS has come into its own in Germany in the last two years as a result of wartime conditions. Long noted for its specialties such as lenses, cut glass, jewelry, Christmas ornaments, etc., the German glass and bottle industry has lagged in mass production methods. However, when the Reich turned to developing products whose raw materials did not depend on imports or first-line military requirements, the possibilities of the glass industry and its production methods were carefully scrutinized.

For years the industry has been made up of a number of small firms, each carefully guarding as trade secrets its production methods. Research beyond immediate industrial problems was not carried on as widely as in the German chemical industry. The first theoretical steps toward making glass fibers, for example, were already taken 60 years ago by Schott and Abbé, but commercial production of other than Christmas tree ornamental fibers to simulate snow and icicles had to wait until fairly recent times.

Mechanized bottle production, for example, did not begin until 1925 in the Reich. The depression and early Nazi attempts to reduce unemployment by spreading work as far as possible tended to retard development of mass production methods again. It was only recently when the shortage of labor became acute and when the industry was asked to furnish satisfactory substitutes for imported items, as copper for tubing, tin cans for preserving foods, and asbestos and cork for insulating material that new impetus was given to improving production methods. Recently a research institute, the "Glasforschungsinstitut G.m.b.H." was formed in Berlin by the plate glass manufacturing association to study chemical and physical properties of glass and to work out improvements in commercial processes for safety glass and glass fibers.

In the bottle industry, production has been rationalized by standardizing sizes. In 1940 Reich production amounted to 240 million preserving glasses, 600 million bottles, 900 million ampules and tablet containers, and 500 million medicinal, pharmaceutical, and cosmetic glass containers, a record in the German hollow glass industry. Although the output of conserving glasses doubled from 1939 to 1940, the Reich's production in this field has to be supplemented considerably by Belgian and French production. Patent difficulties have held up introduction of some of the more modern processes used abroad. The most satisfactory glass-blowing machine in the Reich has been obtained by using the French Roirant-patented machines, manufactured in Belgium.

The greatest production increases have been recorded in safety glass and glass fiber. Glass fiber is widely used as an insulating material in construction of ships and railway cars, and for insulating steam pipes and boilers, and refrigerating units where cork imported from Spain has been used heretofore. In the electro-technical field it is used in place of asbestos and plant fibers for wrapping electric wires and insulating motors. Improvements in glass wool production date back to the development in 1930 in Germany of a centrifuging process which speeded up production tenfold, and the introduction in 1933 of an American blowing process, which speeded up production still further. The "Glasfaser G.m.b.H." has been set up as a marketing organization, and German glass cartels have recently been expanded to include other European glass producers, notably Belgian and French. A use for glass wool which may become of some importance in European climates is as a covering to protect vegetable seedlings which can thereby be planted earlier. Glass fiber is used in increasing quantities to make carpets, draperies, and fireproof theater curtains.

In the chemical apparatus field, improved glass is used wherever possible to replace metals. Many breweries and dairies are equipped with glass pipe lines, while hot water heater coils, sinks, telephone bells, door knobs, and other products are made more and more of glass.

In the machine industry, necessity for conserving materials has led to a simplification in design and elimination of unnecessary materials. In many cases solid castings are being replaced by hollow construction. Metal parts in the framework of portable typewriters, for instance, are being replaced by plastics, while plastics are also replacing lead for marine cable sheathing. Molded plastics are used for small electrical machines in place of metals, especially brass, for housing of installation parts, vacuum cleaners, and hand drilling machines.

Since 1938, successful experiments have been made to utilize special phenol plastics for use in manufacturing domestic gas meters. The Hamburg municipal gas works has developed a meter whose inner parts as well as outside covering are made almost entirely of plastics. Mechanical difficulties had to be overcome, and a material resistant to gas and moisture had to be developed, and a system of elastic couplings had to be devised to join the pipes to the rigid meter box. It is claimed that in the new gas meters already in use in Hamburg, 170,000 kgs. of tin, antimony, solder, bronze, brass, iron and aluminum have been saved.

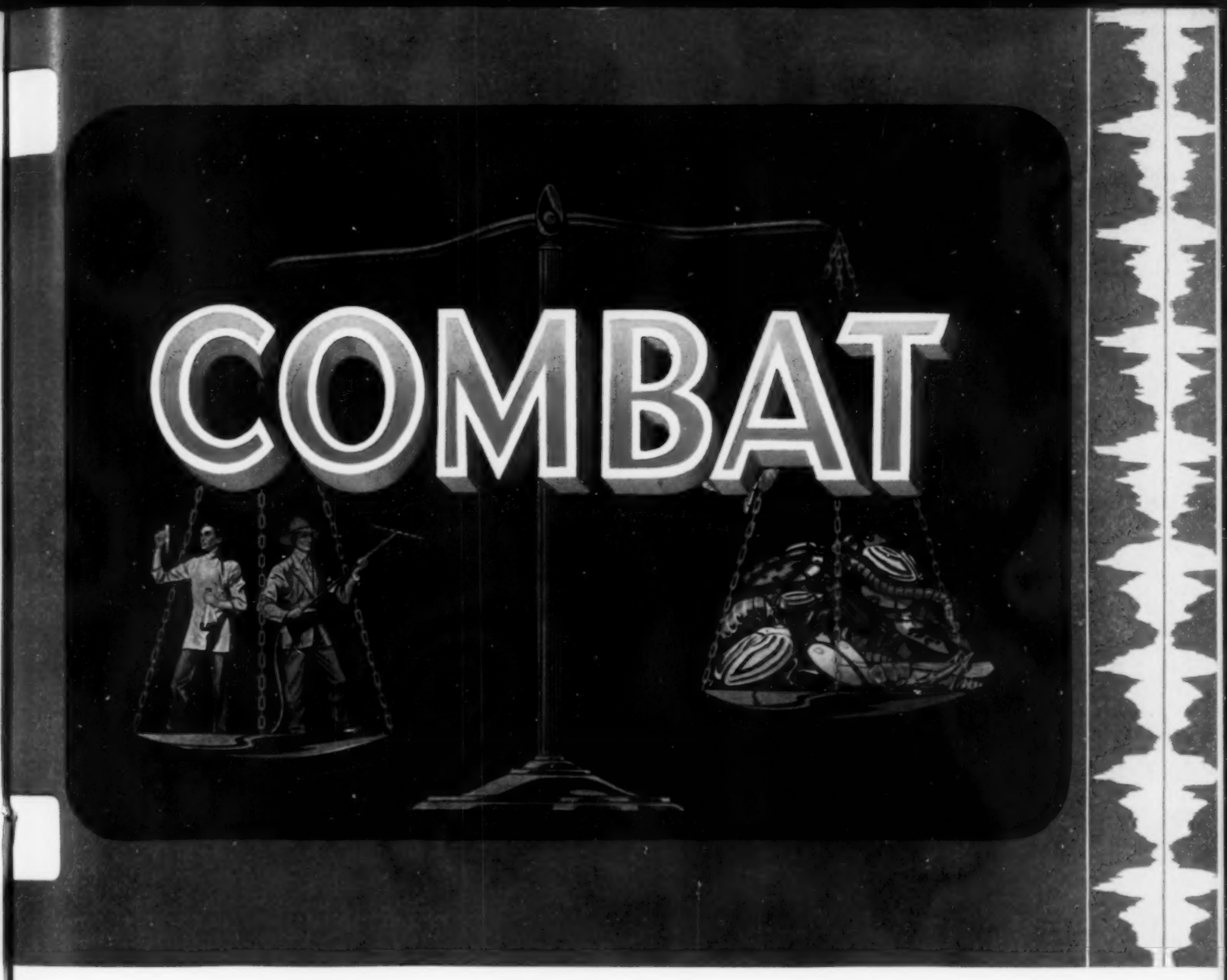
In the field of dentistry, experiments are still under way to develop substitutes for metals and imported materials such as gutta percha. Artificial teeth made of methacrylate resins are claimed to wear better than porcelain and to come close to natural teeth in appearance. The teeth are made by depositing layers over a filler, but an entirely satisfactory filler substance has not yet been found. Plates that do not irritate living tissue and that possess a more natural color effect than products used heretofore are claimed to be made of polymerisates on a vinyl chloride base and on methacrylic acid esters, according to a statement in a recent issue of "Kunststoffe."

Of interest is the announcement that I. G. Farben in its Leverkusen plant has developed a seamless bulging veneer barrel with savings of 40 percent of the wood and 30 percent of the iron used for ordinary wood packing barrels of the same strength, and 60 and 75 percent of the wood and iron respectively of air and watertight barrels. Under a pressure of 125 atmospheres and temperatures around 100 degrees centigrade, thin 100 mm. wide wood strips, which are wound diagonally in alternating directions in two or three layers, are glued to form a veneer as they are pressed into shape from the inside by an expanding rubber form. The total operation takes 8 minutes, and the necessity for stocking different sizes of bent barrel staves is eliminated.

Corrugated cardboard is being used wherever possible to replace wooden boxes. Cosmetic and pharmaceutical products are packed increasingly in paper and glass containers instead of metal cans or tubes, and bottle caps displayed at the last Leipzig fair included a number of new-type stoppers using paper folio, plastics, cardboard, glass, cellophane, hard gelatine, etc.

To cut down on tin imports, 40 percent of which are used normally in the Reich for tin can production, black sheet iron, which is first lacquered and often phosphatized, is used. Goods canned in black sheet iron keep only from 6 to 12 months. The army and the Reich metal office are experimenting with aluminum cans which weigh only one third as much as the tin plate cans. The German army reports that an experimental lot of 300,000 aluminum cans successfully preserved meat, fish, milk, cheese, and mild vegetables as beans and peas, for a period of two and a half years without spoilage. In "Angewandte Chemie" it is admitted, however, that aluminum containers have not been entirely safe for canning acids as in the case of fish marinades, pickled vegetables, sauerkraut, etc.

For cellophane-like sausage casings for which cotton linters have been used in the past, a special type of beech cellulose has been developed. The new product, "Transparit," or cell glass, is made into seamless cellulose tubes. The use of readily available domestic beech cellulose has become possible through increasing its alpha content from 88 to 95 percent.



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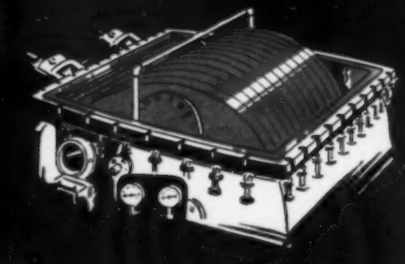
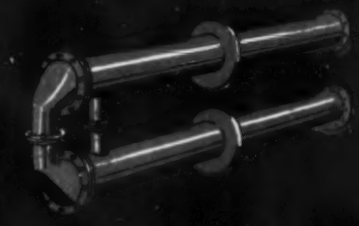


Stainless steel drum and lining of this vacuum filter help keep products clean and pure.



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THE excellent corrosion and heat resistance of stainless steel is being extensively utilized in processing equipment. The illustrations show a few applications. Stainless steel processing equipment brings you these advantages:

Resists Corrosion—resists a variety of chemical solutions and vapors . . . prevents discoloration and contamination.

Prolongs Equipment Life—reduces maintenance costs . . . stainless throughout . . . resists wear . . . cuts replacement costs.

Speeds Production—reduces cleaning time . . . permits higher temperatures and pressures . . . makes possible higher yields.

Although we do not make steel, we have for over 35 years produced "Electromet" ferro-alloys used in making steel. With the knowledge accumulated from this experience, we are in a position to give you, without obligation, impartial assistance in the selection of a stainless steel for your particular problem. If you do not know the fabricators of stainless steel in your area, write us.

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York, N. Y.

In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet

Trade Mark

Ferro-Alloys & Metals

EXPORT TRADE IN CHEMICALS MAKES NEW RECORD UNDER WAR-TIME INFLUENCES

AIDED by a sharp increase in the movement of explosives, exports of chemicals and related products reached a valuation of $30,240,922 in August. This record monthly total brought the figures for the first eight months of the year to $172,584,227 which likewise is a record for the period. With figures available for August, it is possible to compare our current export status with our normal position as represented by the figures for the first eight months of 1939. Official data give a valuation of $91,961,535 for the Jan.-Aug. period of 1939 so we find that war-time influences have increased our trade with outside countries by close to 88 percent measured in dollar volume or somewhat less on a quantitative basis. The totals refer to the commodities included under Group 8 in the export statistics published by the Bureau of Foreign and Domestic Commerce. They do not include such products as vegetable oils, naval stores, and sulphur.

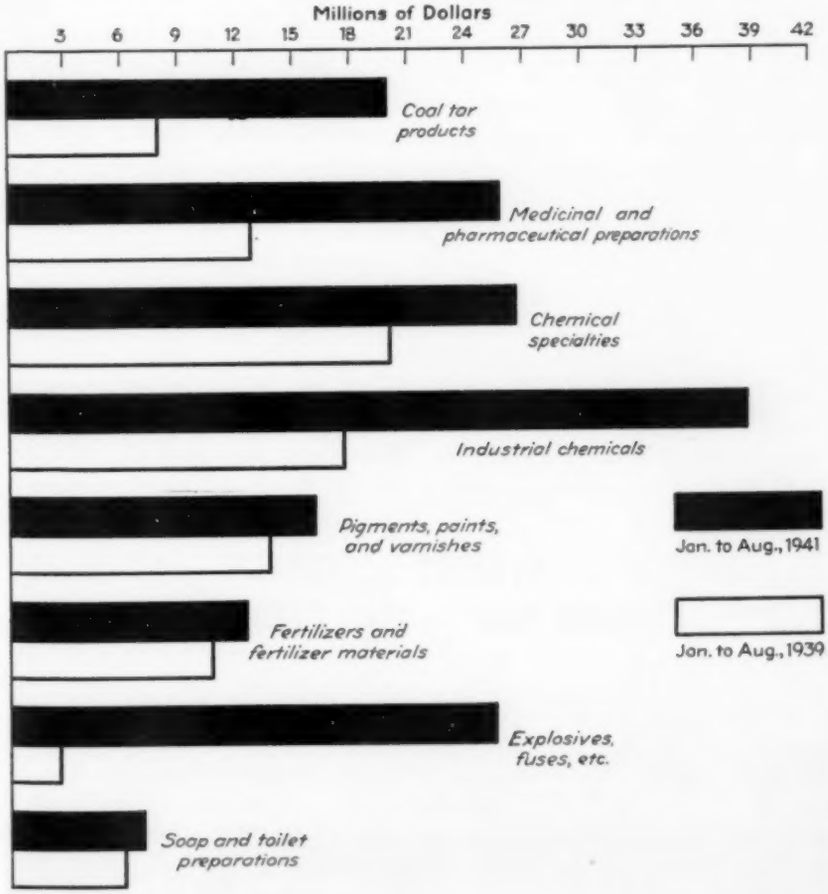
Ordinarily, our outward shipments of explosives do not run to large volume and in the 1939 period they were valued at less than three million dollars while in the comparable time this year, they exceeded twenty-five million dollars or an increase of more than 823 percent. Approximately 60 percent of the present years exports were accounted for by smokeless powder which was practically non-existent in the 1939 trade.

The coal-tar group ranked second from the standpoint of proportionate increase with a gain of close 148 percent for the 1941 period. Toluol, which previously had not figured in the export statistics was shipped out to the extent of 19,224,318 lb. in the present year and foreign buyers obtained 17,517,979 lb. of colors and dyes in comparison with 6,752,802 lb. in the corresponding 1939 period.

Shipments of industrial chemicals more than doubled the 1939 totals with increases running through most of the individual commodities. Calcium carbide jumped from 3,700,808 lb. in 1939 to 52,417,564 lb. Acetone, which had found a much more than normal export outlet in 1939 with 12,119,961 lb. shipped out in the first eight months made further gains in the current tabulations with the Jan.-Aug. total reaching 16,088,133 lb. Potassium compounds, not including fertilizer materials, in the same periods rose from 3,549,311 lb. to 16,835,347 lb. and sodium compounds from 353,225,523 lb. to 447,462,043 lb.

Deliveries of medicinal and pharmaceutical preparations to outside countries likewise more than doubled in

Comparison of export trade in chemicals and related products



★

Defense Industries are making Better Products— with the

AIR-FLOAT SEPARATOR

Yes — better welding rods; improved special steels—through improvement in the quality of *raw materials* (chemicals and ores)—made possible by the AIR FLOAT SEPARATOR. The significant fact is that over 70% of our business today is Defense Business. And now consider *this* fact—the AIR FLOAT SEPARATOR brings you

7 DISTINCT ADVANTAGES The Air-Float Separator Offers

1. Higher grade product, less loss than wet separation.
2. No water supply needed. Can be located anywhere. Saves pump money.
3. Increases capacity, reduces units, space, power costs.
4. Greater sensitivity to slight difference in densities, successfully treats materials which "wet" methods cannot concentrate.
5. Larger sizes may be treated. Fine grinding eliminated. Slime tonnage cut down.
6. Dry finished product handled, shipped, marketed at low cost.
7. Handles not only ores but slags, drosses, chemicals, beans, seeds and any dry material composed of mixtures of different weights.

Allow us to submit recommendations, based on your requirements. Arrange to send us a suitable sample for laboratory test runs.

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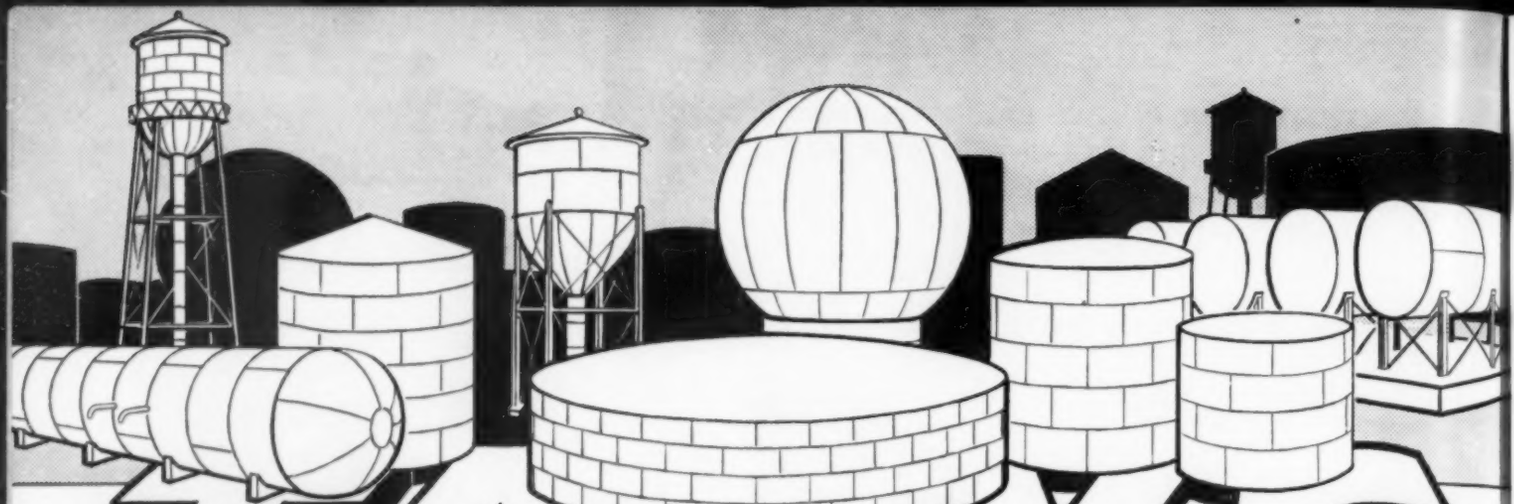
S&S PROCESS



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WHEN "Production—and still more production!" is the keynote of your operations, turn with confidence to Pittsburgh-Des Moines for prompt fulfillment of your expanded tank storage requirements.

With two large and efficient fabricating plants to serve you—a staff of engineers thoroughly versed in every phase of storage tank design—plus the long years of experience that counts for most in the pinches, you'll find P·DM a source of supply that is absolutely dependable.

We design, fabricate and erect tanks for handling every liquid properly contained in metal, whether flat-bottomed types at grade or supported on grillage; suspended-bottom types which are hemispherical, hemi-ellipsoidal, conispherical or conical in design; or full spheres for holding liquids or gases under pressure. Trained erection crews, competently supervised, provide correct installation, and your satisfaction is assured under a responsible guarantee.

Our present stocks of materials are good. What types and sizes of tanks do you require?

Any Metal: STEEL . . . IRON . . . ALUMINUM* . . . EVERDUR . . . MONEL* . . . STAINLESS STEEL* . . . NICKEL CLAD* . . . STAINLESS CLAD* . . . LEAD LINED . . . RUBBER LINED.

*Priorities permitting

Let us arrange a discussion of your storage-tank problems with a P·DM engineer, and submit preliminary estimates for your consideration . . . without obligation of any kind!

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value in the intervening time and the chemical specialties group registered a gain of more than 32 percent.

The Foreign Commerce Department of the Chamber of Commerce of the United States has just issued a review and analysis of our world trade for the first half of this year with comparisons for 1940. Comparing those six-month periods, the review finds an increase for the present year of 11 percent for chemicals and related products which represented 6 percent of our total export trade. The analysis further shows that coal-tar products, medicinal and pharmaceutical products, industrial chemicals, fertilizers, and toilet preparations all made moderate gains. Exports of explosives also recorded a 51 percent increase. Sodium compounds shipped abroad exceeded the 1940 half-year quantity by 5.5 percent and the five-year average by 16 percent. Exports of fertilizer were 19 percent larger than in 1940 but were 24 percent under the five-year average, while carbon black declined below both periods by 40 percent and 31 percent respectively.

Discussing our export trade as a whole the review says that finished manufactures continued to dominate the trade with more than 70 percent of our shipments abroad, by value, falling into that category. Details for shipments of chemicals according to countries of destination are not included but of our entire exports, about 62 percent are credited as having gone to the British Empire, chiefly 30 percent to the United Kingdom and 20 percent to Canada. Exports to Greece increased materially but shipments to other countries on the continent of Europe declined to a considerable extent.

SWIFT & CO. FELLOWSHIPS FOR RESEARCH IN NUTRITION

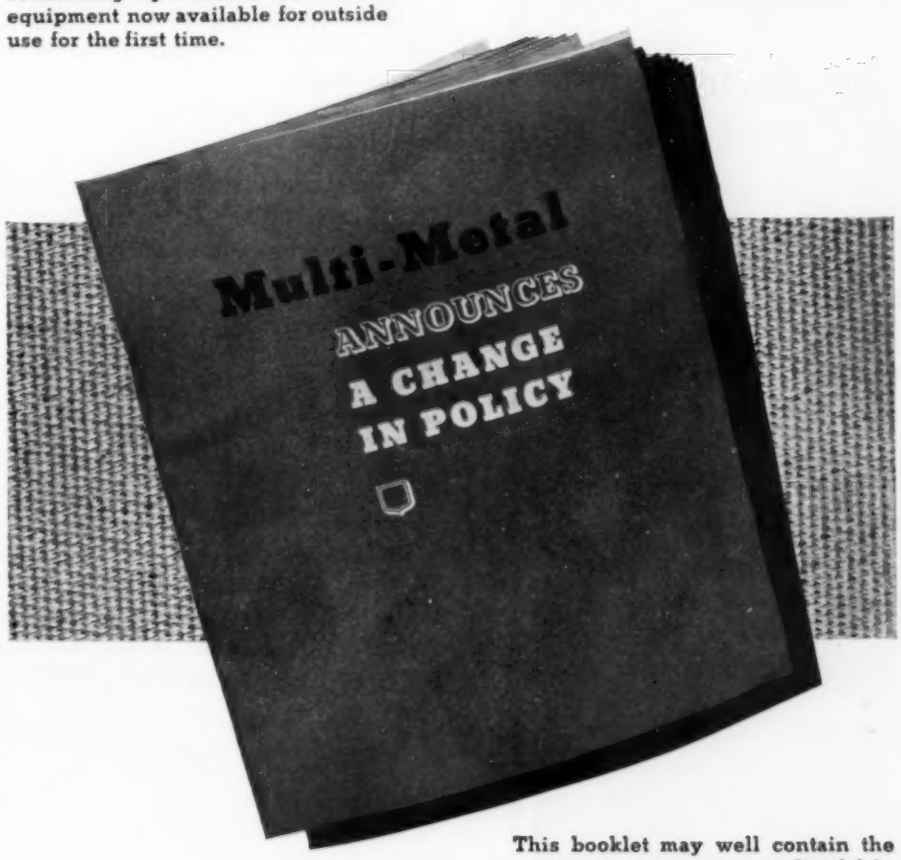
Scientific attack on problems of American diet has been furthered with the announcement by Charles H. Swift, chairman of the board of directors of Swift & Co., Chicago, of the establishment of a series of fellowships for research in nutrition. The fellowships are intended to aid the federal government in its long-range national nutrition program.

The fellowships provide for special research to be undertaken in laboratories of universities and medical schools with funds which the company has set aside as grants in aid, beginning November 1. The fellowships will be for one year but may be renewed where the project warrants it.

Any fundamental study of the nutritive properties of foods or the application of such information to improvement of the American diet and health will be eligible for consideration for a grant, according to Dr. R. C. Newton, vice-president in charge of the company's research laboratories, who will coordinate the program.

HERE IS THE MULTI-METAL ANNOUNCEMENT THAT IS MAKING BIG NEWS

There is vital information in this booklet for your production staff, concerning specialized fabrication equipment now available for outside use for the first time.



This booklet may well contain the answer to an urgent specialized fabrication problem in your own plant. A copy is yours just for the asking.

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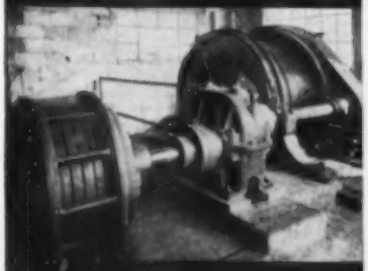
To help SOLVE YOUR DRIVE PROBLEMS

Hydraulic dredge which was equipped with Jones reducers as shown in view below.

Drums and control mechanism of hydraulic dredge driven through Jones reducers.



A hoist for a coal mine driven by a Jones herringbone speed reducer.

Jones worm-helical speed reducer driving an agitator in a paper mill.

Jones speed increaser driving a centrifugal pump from a Diesel engine.

FOR MANY YEARS the W. A. Jones Foundry & Machine Co. has been called upon to help solve a wide variety of difficult drive problems involving the use of speed reducers. In many cases these drives have required the development of special reducers built to fit the specific requirements of the job.

As a result of these years of experience involving such a wide range of special problems the Jones organization has collected a vast amount of technical data relating to work in various fields.

The accompanying illustrations are presented to give a general idea of the services the Jones organization is prepared to render on drive problems where special speed reducers are required.

If you wish detailed information on any of the Jones transmission products or would like copies of the various Jones catalogs, we shall be pleased to serve you.

ANY, OR ALL, OF THESE JONES CATALOGS WILL BE SENT ON REQUEST

No. 70—Jones Herringbone Speed Reducers
No. 71—Jones Cut and Molded Tooth Gears
No. 75—Jones Worm Helical Speed Reducers
No. 55—Jones Spur Gear Speed Reducer Units
No. 68—Jones Worm Gear Speed Reducers
No. 60—Jones Lemley Friction Clutches
No. 58B and 76—Jones V-Belt Sheaves
No. 78—Jones Flexible Couplings
No. 56—Jones Roller Bearing Pillow Blocks
No. 69—Jones Cast Iron Pulleys
No. 61—Jones Power Transmission Equipment

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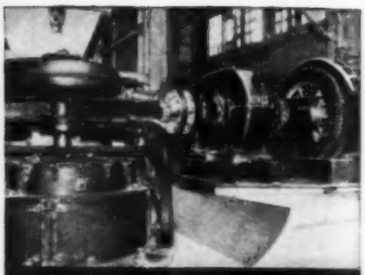
4415 Roosevelt Rd., Chicago, Ill.

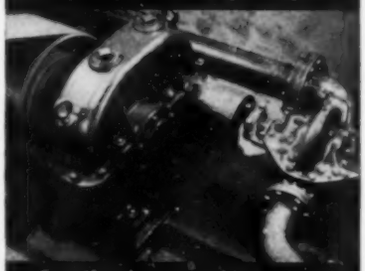
Jones

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
V-BELT SHEAVES • CUT AND MOLDED TOOTH GEARS
FRICTION CLUTCHES • TRANSMISSION APPLIANCES
PULLEYS • ANTI-FRICTION PILLOW BLOCKS

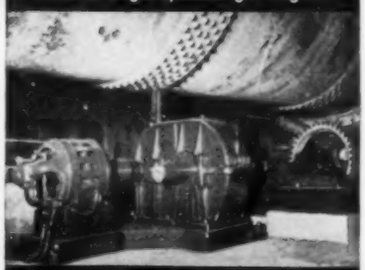


Bradley Hercules mill driven by Jones herringbone speed increaser from synchronous motor.

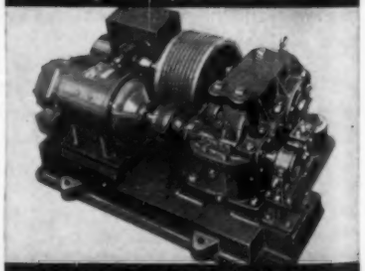
Oil field pumping unit using single type herringbone reducer driven by belt from gas engine.



Centrifugal pump driven by a Jones speed increaser from belt drive to single cylinder gas engine.



A rotary kiln in a cement plant driven by Jones herringbone speed reducer.



Jones automatic stock line recorder drive for use in connection with operation of blast furnace.

DU PONT BUILDING CHLORINATED SOLVENTS PLANT AT WYANDOTTE

Construction of a new plant for the manufacture of chlorinated hydrocarbon solvents on a recently acquired 23-acre site at Wyandotte, Mich., has begun. The plant, a unit of Du Pont's R. & H. Chemicals Department, is expected to be ready in the summer of 1942. Production will supplement that of a Du Pont plant at Niagara Falls.

Industries participating in the national defense program will use most of the solvents to be produced at Wyandotte. A principal industrial use of solvents is for removing oil and grease from metals which are to be plated, lacquered or painted.

The site for the plant fronts on the Detroit River. Detroit Shipbuilding Co. owned and used the site during the last war. Railroad lines of Wyandotte Terminal Co. and Michigan Central Railroad will serve the plant.

A manufacturing building, warehouse, gate house, pump house and six large storage tanks will be constructed, and an existing two-story reinforced concrete building will be remodeled to serve for offices, shops, laboratories, shower rooms and a medical unit.

POWER REQUIREMENT FOR SOYBEAN EXTRACTION

To the Editor of Chem. & Met.:

Sir:—We have read with great interest your article in the September 1941 issue of *Chemical & Metallurgical Engineering* regarding the solvent extraction plant for soybeans at Cedar Rapids, Iowa.

The flow sheet given is a very good one as it is quite comprehensive and yet is not unduly complicated.

There is one thing in the write-up, however, which we believe is slightly misleading. The power requirements for such a plant given as 65 kwh. per ton is evidently the figure for the entire plant including feed mixing, grinding, pelleting, and so forth, and is not representative of the power required for the functions of preparation and extraction alone.

We believe that a more accurate figure would be 23 kwh. per ton for preparation, extraction and toasting. This will be divided approximately as follows:

Preparation	9 kwh.
Extraction	9 kwh.
Toasting	5 kwh.
Total	23 kwh.

The labor given as 0.7 man hours per ton, we believe is quite accurate and covers only the three functions listed above and not other items incident to feed grinding, mixing and handling, ordinarily encountered in a feed processing plant.

C. W. Bilbe
Engine and Condenser Department
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

Products that may be damaged by the absorption of moisture find protection in Bemis Waterproof Bags. There have been instances when products in these superior shipping containers have gone through floods undamaged.

In addition to keeping dampness out, Bemis Waterproof Bags can be made to keep moisture in—retain desirable aromas and repel objectionable odors—shut out dust and dirt—resist acids and grease. And because of their strength and toughness, Bemis Waterproof Bags provide extra protection against rough handling.

WATERPROOF DEPARTMENT

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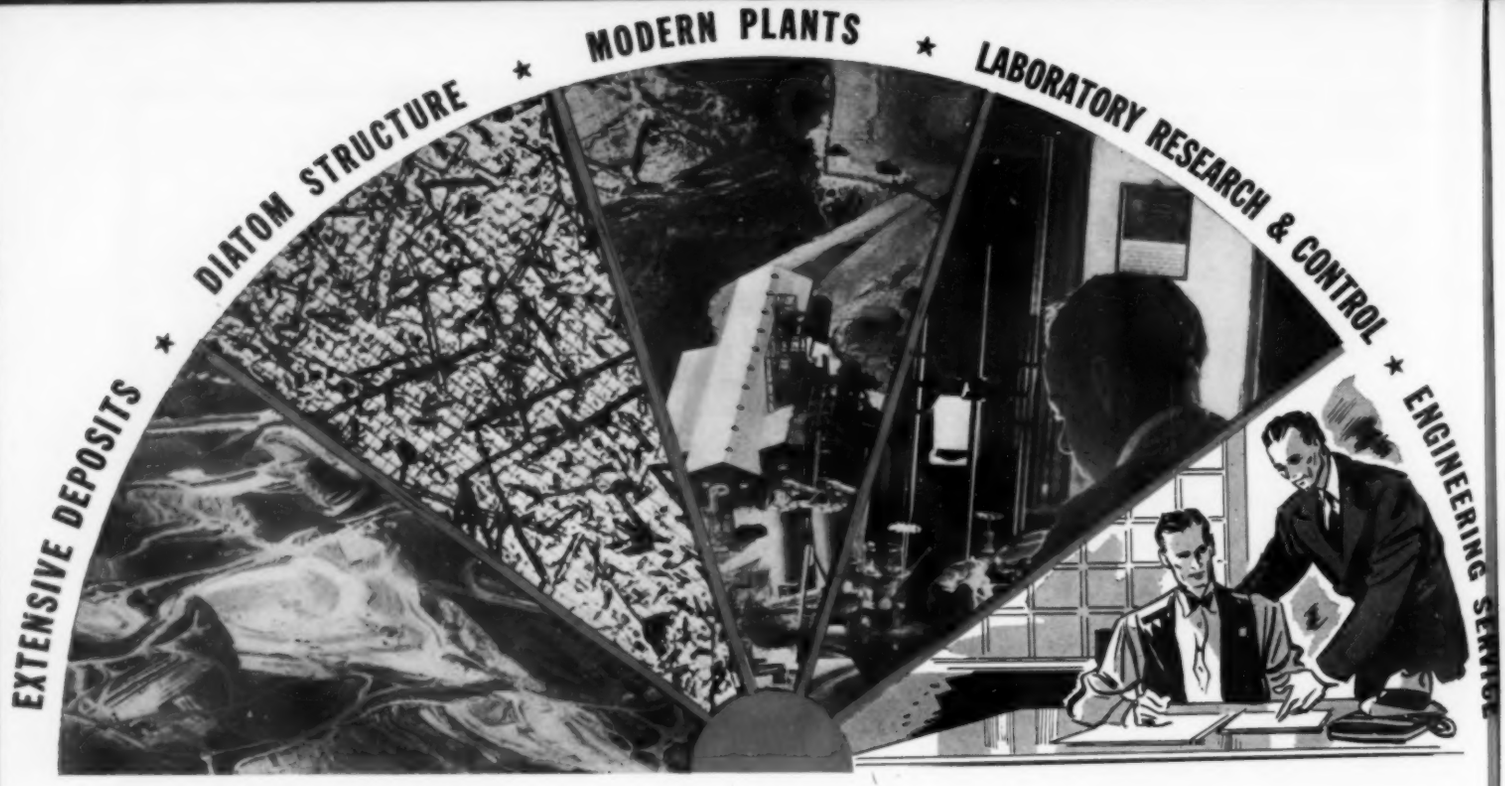
ST. LOUIS, MO. • BROOKLYN, N. Y.



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QUALITY DIATOMACEOUS MATERIALS FOR THE PROCESS INDUSTRIES

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Special grades for improved processing and lower costs in such products as paint, paper, plastics, rubber, polish and many others.

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Dicalite Insulation saves fuel and improves operation of furnaces, boilers, kilns and other high temperature equipment.

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. . . are Dicalite catalyst carriers, Dicalite absorbents, Dicalite for Concrete, Dicalite for Asphalt, and other special materials.

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PERSONALITIES

✦ DUNCAN A. MACINNES of the Rockefeller Institute of Medical Research, has been awarded the 1942 William H. Nichols Medal of the New York Section of the American Chemical Society. Cited for outstanding investigations on electrolytes and the development of technique which have immeasurably enriched both the theory and practice of modern electrochemistry. Dr. MacInnes has been credited with important contributions to the development of the glass electrode which is used widely in industry and with notable investigations in the field of biological chemistry.

✦ ROBERT J. MOORE, manager of the development laboratories of the Bakelite Corp., Bloomfield, N. J., has been elected as a member of the corporation of Brooklyn Polytechnic Institute, Brooklyn, N. Y.

✦ HAROLD S. MITCHELL has succeeded R. C. Newton as chief chemist of Swift & Co. He will be in immediate charge of all branches of the company's scientific department. The three men who have been named to assist Mr. Mitchell are Dr. H. E. Robinson, Dr. H. H. Young and Mr. C. C. Zeigler. After graduating from Syracuse University in 1912, Mr. Mitchell joined Swift & Co. and has served that organization in its research division, sales, service and research, and as assistant chief chemist from 1939 to 1941.

✦ L. G. LAWRENCE has transferred from the Aluminum Company of America (Cleveland Works) to the aluminum production and fabrication plant of Reynolds Metals Co. at Sheffield, Ala.

✦ MARTIN H. ITTNER has been selected to receive the Perkin Medal for 1942. Dr. Ittner, chief chemist for Colgate-Palmolive-Peet Co., will receive the award on January 9 at a meeting of the Society of Chemical Industry in New York City.

Martin H. Ittner

Blank-Stoller

C. R. DeLong, Stephen L. Tyler, S. D. Kirkpatrick, J. L. Bennett

✦ S. D. KIRKPATRICK, editor of *Chem. & Met.*, has been elected president and J. L. Bennett, manager of chemical operations, Explosives Department, Hercules Powder Co., vice-president of the American Institute of Chemical Engineers for the year 1942. The newly elected directors of the Institute are Mark E. Putnam, Dow Chemical Co., Warren L. McCabe, Carnegie Institute of Technology, Thomas H. Chilton, E. I. duPont de Nemours & Co., Walter G. Whitman, Massachusetts Institute of Technology. C. R. DeLong and Stephen L. Tyler were reelected, respectively, treasurer and secretary.

✦ NORMAN A. RUSTON, who has been in the sales division of the Emery Industries, Cincinnati, Ohio, for the past 12 years, has been promoted to general sales manager. Mr. Ruston is a graduate of Rose Polytechnic Institute, class of 1920, with a degree in chemical engineering.

✦ CLIFFORD W. SAMPSON, who has been in the sales and technical divisions of Emery Industries, Cincinnati, Ohio, for several years, and who has recently been Southeastern manager at Charlotte, N. C., will return to the home office to become chemical sales manager. Mr. Sampson is a graduate of Lowell Technical Institute, class of 1928, with a B.T.C. degree in textile chemistry.

✦ GEORGE W. PHILLIPS, who has been Southeastern representative for U. S. Industrial Chemicals, stationed at High Point, N. C., is on leave of absence. He is now at the Baton Rouge (La.) Air Base on active duty in the army.

✦ C. FRED GURNHAM has taken a position with Fred S. Carver, New York City, to conduct engineering research and development on various applications of hydraulic pressing. He was previously on the chemical engineering faculty of Pratt Institute, where he had charge of planning and installing the chemical engineering laboratory, in addition to his teaching duties.

✦ J. FRED REEVES, acting superintendent of the Anniston, Ala., plant of Monsanto Chemical Co., has been promoted to assistant plant manager, according to the announcement of Herbert Weaver, acting plant manager. In 1924 Mr. Reeves began work at the Anniston plant, then a property of Southern Manganese Co. In 1934 he was made supervisor of the abrasives plant, and three years later crude acid and calcium carbide production were placed in his charge as well.

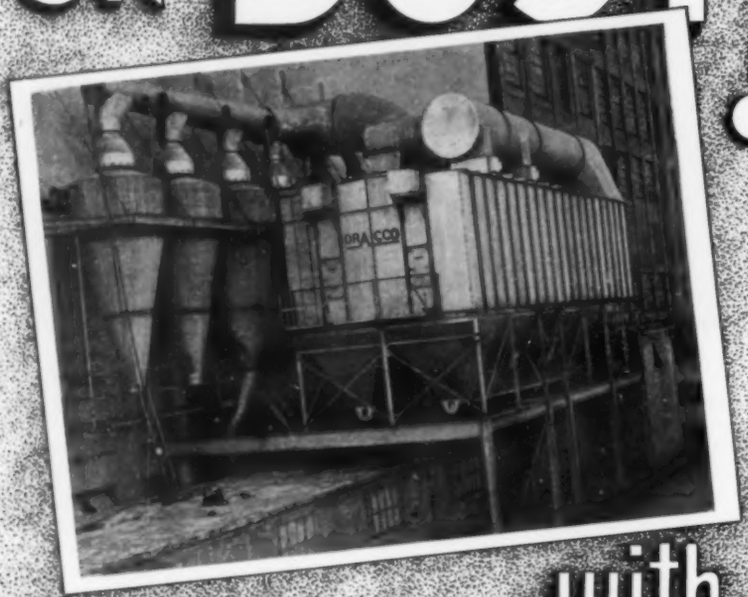
✦ CHARLES F. LUMM has been named to the technical staff of Battelle Memorial Institute, Columbus, Ohio, where he has been assigned to the division of ceramic research. Mr. Lumm is a graduate in chemical engineering of Purdue University. He was associated with the Byerlyte Corp., Newark, Ohio, prior to joining the Battelle staff.

✦ IRVIN LAVINE, head of the Department of Chemical Engineering, University of North Dakota, has been granted a leave of absence. He has joined Industrial Research Service, Dover, N. H., an organization of consultants in chemical and industrial engineering.

✦ LOUIS WEISBERG has been elected president of the Association of Consulting Chemists and Chemical Engineers. The newly elected vice-president is H. P. Trevithick. The secretary is Wm. C. Bowden, Jr., of Ledoux & Co., and the treasurer is Jerome Alexander.

✦ ROBERT E. DUNHAM has been appointed chief consultant for Harry R.

CRACK-DOWN ON DUST!



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PNEUMATIC CONVEYORS • DUST COLLECTORS

Lewis Co., petroleum industry consultants. Mr. Dunham has been a member of the enginering staff of Sinclair and Hyvis Oils, Inc.

✦ RICHARD S. SHUTT, head of division of chemical research at Battelle Memorial Institute, Columbus, Ohio, is serving as chairman of the Columbus Section of the A. C. S.

Roy C. Newton

✦ ROY C. NEWTON has been elected vice-president of Swift & Co., Chicago. Dr. Newton has been head of the company's research laboratories since 1931. In his new duties he will remain at the head of the packing company's research division. He was born in El Reno, Okla., in 1896, and was graduated from Oklahoma A. & M. College in 1921 with the degree of M.S. He received his Ph.D. degree from the University of Chicago, in 1924. He was later an instructor in chemistry at Oklahoma A.&M. College and Purdue University.

✦ GEORGE D. BEAL, assistant director of Mellon Institute of Industrial Research, Pittsburgh, will be presented with the Remington Honor Medal by the New York Branch of the American Pharmaceutical Association, December 4.

✦ HERBERT WEAVER has been promoted to acting plant manager of the Anniston, Ala., plant of Monsanto Chemical Co. Mr. Weaver has been in Annison since 1928, the year he graduated from the chemical department of Lehigh University. He has been successively in the research, development and production departments, his latest position being assistant plant manager.

✦ THEODORE M. MILLER has been granted a leave of absence from his work in the consumer testing department of Foster D. Snell, Inc., Brooklyn, N. Y., in order that he may join the force of the Office of Price Administration, Washington, D. C.

✦ FOSTER D. SNELL has been elected president of the Columbia Graduate Alumni for 1941–42.

✦ ROBERT H. ABORN, a member of the staff of the research laboratory of the United States Steel Corp., Kearny, N. J., has been awarded the Lincoln gold medal donated to the American Welding Society by James F. Lincoln, president of the Lincoln Electric Co., Cleveland. The Lincoln Award is presented each year for the paper which contributes most to the year's development of welding.

✦ CHARLES L. BRYDEN has accepted a position with the International Filter Co., Chicago, Ill., as a research engineer.

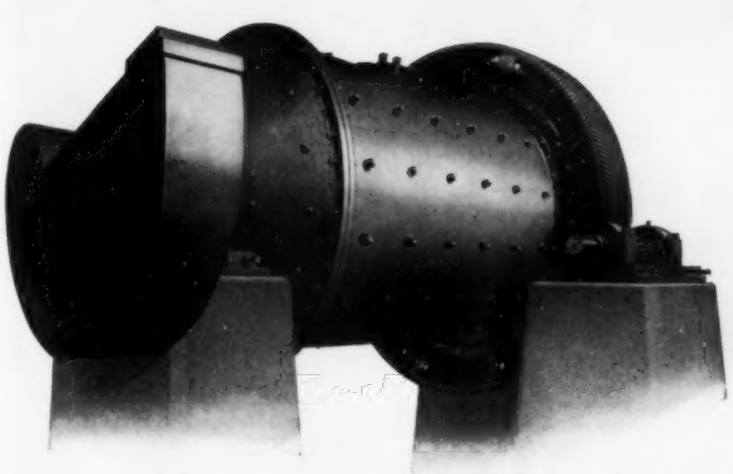
✦ CARL L. WALLFRED has been named to the technical staff of the division of process-metallurgy research at Battelle Memorial Institute. A graduate of the University of Minnesota, Mr. Wallfred has had 20 years' experience in chemical and metallurgical research with the U. S. Bureau of Mines, the Northwest Research Foundation, and Mines Experiment Station of the University of Minnesota, the Minnesota Mining & Manufacturing Co., and the A. O. Smith Corp.

✦ EARL C. MAUND has been appointed to a position in sales and engineering at the Chicago office of Manning, Maxwell & Moore, Inc., of Bridgeport, Conn. Mr. Maund was formerly in the engineering department of Sinclair Refining Co., at Chicago, Ill., and the Cities Service at Shreveport, La.

Rentschlers Studio

George Granger Brown

✦ GEORGE GRANGER BROWN has been appointed chairman of the department of chemical and metallurgical engineering at the University of Michigan. He succeeds Prof. Alfred H. White, who has asked the University authorities to be relieved of administrative responsibilities. The changes become effective at the close of the present semester. Dr. White will remain as professor of chemical engineering. Professor Brown joined the faculty at Ann Arbor in 1920, after having served with the Aluminum Company of America, the Chemical Warfare Service, Universal Aniline Dyes & Chemicals, and Union Special Machine Co.



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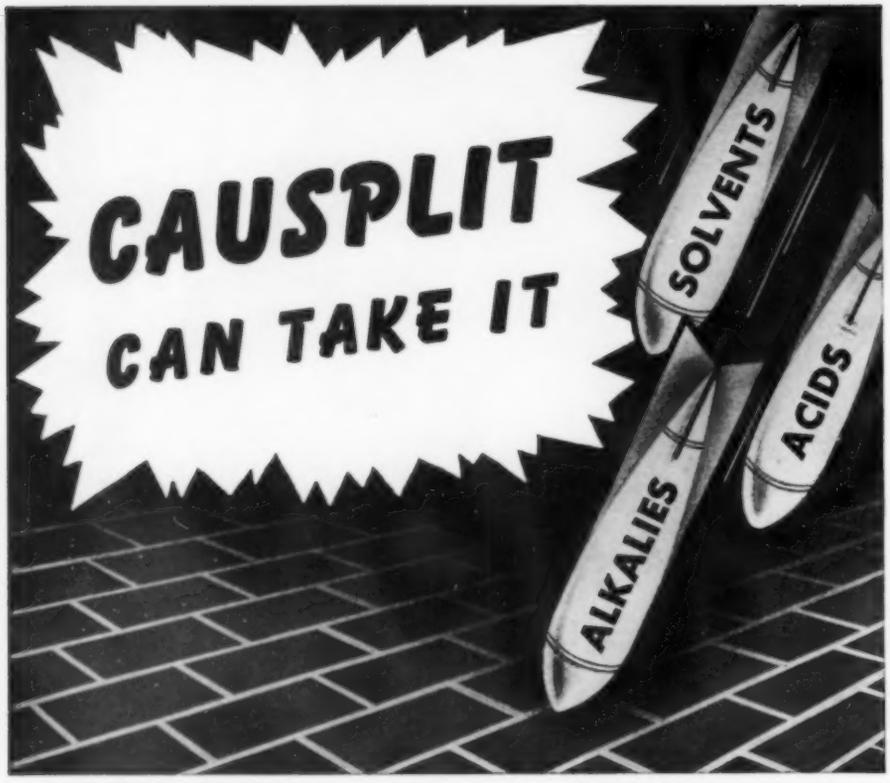

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✦ J. LANIER CHRISTIAN, superintendent of furnaces of Monsanto Chemical Co.'s elemental phosphorus plant at Monsanto, Tenn., has been promoted to assistant plant manager, according to A. T. Beauregard, recently appointed manager of the Tennessee plant. In 1933 Mr. Christian came to Anniston, Ala., to join Swann Chemical Co., later to become Monsanto's Phosphate Division. He was successively in the research, production and pilot plant departments at Anniston. During the construction of the phosphorus plant at Monsanto, Tenn., Mr. Christian was transferred to the new operation. In the fall of 1937 he was made superintendent of furnaces.

✦ THOMAS E. MILLIMAN, whose appointment to the food section of the Office of Price Administration was announced recently, has also been placed in charge of work on insecticides and fungicides in the chemical section. Mr. Milliman came to OPA from the Grange League Federation Exchange of New York, New Jersey and Pennsylvania, where he supervised the spray materials, lime and fertilizer business for 14 years.

✦ CHARLES J. SLUNDER has been named to the research staff of Battelle Memorial Institute. He has been assigned to the Institute's division of electrochemical research. A graduate of Massachusetts Institute of Technology in electrochemical engineering, Mr. Slunder has had 15 years' experience in the field of industrial electrochemistry. Prior to joining the Battelle staff he was with the Aluminum Co. of America, and earlier held positions with the United States Rubber Co., Packard Motor Co., and Dodge Bros., division of Chrysler Corp.

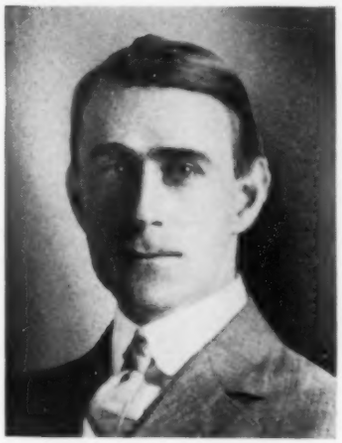
✦ JEROME M. CROCKIN, a graduate of Virginia Polytechnic Institute, holding B.S. and M.S. degrees in chemical engineering, has been appointed as assistant professor of chemical engineering at Michigan College of Mining and Technology. Mr. Crockin has been associated with the Hercules Powder Co., and with the Solvay Process Co.

✦ MARRIOTT W. BREDEKAMP, a graduate of the University of Maryland, holding a doctorate in chemical engineering, has been appointed as instructor in chemistry at the Michigan College of Mining and Technology.

✦ EDSON W. FORKER, has been appointed vice-president of the Blaw-Knox Div. of Blaw-Knox Co., Pittsburgh, Pa. He will be in charge of the chemical and process equipment department.

✦ JOHN BERNAL BIKER, assistant superintendent of the phosphate plant and storage of the Consolidated Mining & Smelting Co., was recently given a farewell banquet by the staff of the chemical and fertilizer department, Trail, B. C. Mr. Biker has left for Victoria, to begin his training course preparatory to being commissioned in the Royal Canadian Engineers.

OBITUARY



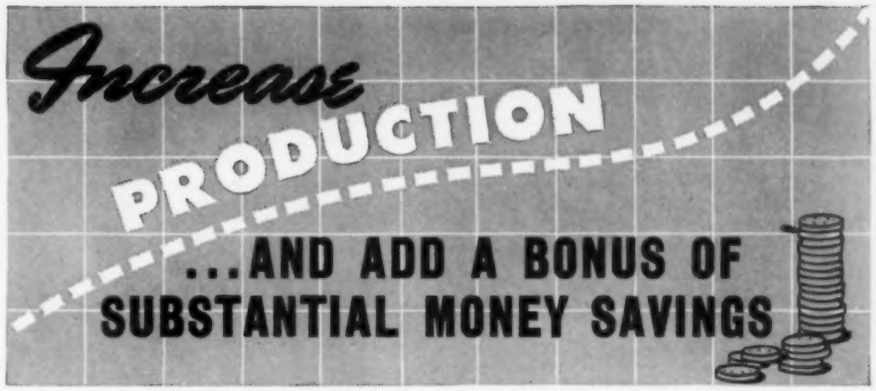
A. C. Houghton

✦ A. C. HOUGHTON passed away October 11. He was born in London in 1874, and graduated in chemistry from Mason College, Birmingham, in 1985. A year later he came to the United States, joining the Solvay Process Co. in Syracuse. Later he entered the University of Michigan, from which he graduated in 1905, but returned to the Solvay Co., where he eventually succeeded Dr. Louis Jones, the chief chemist, in Semet Solvay. After 25 years of distinctive service with this company he went to California to live. 1905 with a B.S. degree in chemistry Clark Chemical Co. of Bartlett as chief chemist. Recently he became interested in a process for the recovery of mercury in Indian Wells Valley.

✦ CHARLES A. NEWHALL died on September 9 after an operation. Mr. Newhall had been associated at Permanente, Calif., with the Permanente Corp., manufacturing magnesium metal by the Hansgirg process. He was born March 6, 1882, and graduated from the University of California in 1905 with a B.S. degree in chemistry with engineering. Later he did special work at the University of Washington on electrochemical problems. From 1911 to 1934 he was owner of consulting office, research and testing laboratories, and from that time until May, 1939, was with the State of Washington, Department of Health Laboratories as chemical engineer. Two years ago he went to California to live, and there became connected with the Permanente organization.

✦ ERNEST B. DRAKE, professor of chemical Engineering at Wayne University, Detroit, Mich., died October 22 after an illness of only a few hours.

✦ WILLIAM A. NOYES, professor emeritus at the University of Illinois, died October 23 at the age of 83 after a heart attack suffered on the previous Sunday. The Noyes Chemical Laboratory on the Campus which was named for him two years ago is a monument to his career.



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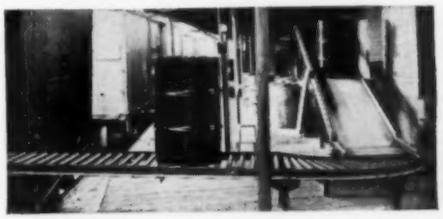

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NEWS OF PRODUCTS AND MATERIALS

PROTECTIVE METAL COATING

A metal coating compound known as AMCO metallic coating powder, Brand "K", has been developed by the American Solder and Flyx Co., Philadelphia, Pa. This new product is designed for making repairs to damaged tin coatings. While the finished coating has the appearance of tin, and matches perfectly with the surrounding hot-dipped tin coating, it has an advantage not possessed by the original tin. These coatings are completely rust-resistant and will protect the underlying iron or steel to the same extent as hot-dipped zinc coating of the same thickness. This unusual and important property of the coating material is due to the fact that when in contact with iron or steel, in a corrosive medium, it is electro-positive and therefore affords protection against rust and corrosion. The material is intended for use wherever an original tin coating has been damaged in handling, worn away through use, or burned away in a welding operation. Since the melting point of the Brand "K" is lower than that of tin, the original coating is not melted or disturbed in any way by the application. The coating on the repaired area joins with the undamaged surrounding areas of tin forming a continuous and protective surface.

CONSTRUCTION MATERIAL

The development of a new nonmetallic material designed to displace sheet aluminum in many important uses, has been announced by the United States Rubber Co., New York. In presenting the new substance, identified only as formula C-102, company officials said that it was made of fibrous and rubber-like ingredients, and that except for small amounts of rubber, consisted entirely of non-strategic materials unaffected by priorities. The material was developed by the company engineers seeking a container for self-sealing fuel tanks already in production by the company. It already has been tested and approved for this use by the United States Army, company representatives have stated.

Slightly thicker than ¼ in. aluminum sheets as used in fuel tanks, it still is one-third lighter. It is said to have 60 percent of the tensile strength of aluminum and under gunfire to resist ripping or shattering.

PAPER FURNISH

The whitest grade of diatomaceous earth ever commercially produced is known as Celite No. 340, according to Johns-Manville, New York. This grade of Celite has been designed to replace part of the titanium oxide in paper furnishes. Measured by the General Electric—Paper Institute Brightness Tester, the material shows a brightness of 95. It is a finely divided grade with high bulking and high absorption properties.

LUBRICANT

Sintered bearings made with metallic powders can now be readily released from their molds by the use of a new lubricant. It is known as Acrawax C and is especially interesting since it is a synthetic wax made entirely from domestic raw materials and therefore readily available. Acrawax C is a hard, brown wax having a melting point of 134 deg. C made by Glyco Products Co., Brooklyn, N. Y. The method of procedure for use as a mold lubricant is to blend 15 percent of Acrawax C and 85 percent of stearic acid by melting together; then 2 to 4 percent of this wax mixture based on the weight of the metallic powder is added to the metallic powder and the whole heated above the melting point of the wax mixture and tumbled in the usual way. The metallic powder after pressure forming will release readily from the mold.

WATERPROOFING COMPOUND

Four waterproofing compounds which are effective seals for concrete, brick, stone and other types of masonry, as well as for wood and composition materials such as shingles, have been developed by the Primoid Products Crop., New York. These products can be used to prevent or correct any leakage problem from near moisture to a flowing stream. Primoid Standard is a clear rubber-base liquid which can be either sprayed or brushed on. It penetrates deep into the pores of the material to be waterproofed, effectively sealing the surface and adhering permanently. It will not crack or peel off and is not affected by heat or cold. Either dry colors or colors ground in oil can readily be mixed with Primoid Standard. It can also be used as a coating for iron, steel and other metals, and will prevent corrosion because it is resistant to oils, alcohol, gasoline, brine, acids and other chemicals.

RESIN

A resin derived from gum or wood rosin, pale in color free of metals, and having a low acid number and appreciably higher melting point and higher viscosity than any natural resin, was announced by the Naval Stores Department of Hercules Powder Co. The new resin is known as Poly-Pale resin. It is produced by the polymerization of the unsaturated resin acids in rosin. Approximately 40 percent of the resin consists of such polymers, the remaining portion being

the normal constituents of rosin. The melting point range of the new resin, 98 to 103 deg. C., is 15 to 20 deg. higher than the melting point range for gum and wood rosins from which it is made. The melting point of ester gum and other resins made from Poly-pale resin is similarly higher. Viscosity is correspondingly higher. Ester gum modified phenolic and maleic anhydride resins and metallic resinates made from Poly-pale resin have correspondingly higher melting points and viscosities than similar resins obtained from gum or wood rosin. The new resin reacts readily with all of the common metals used in making metal resinate driers. It is soluble in most organic solvents including hydrocarbons, alcohols, ethers, ketones, esters and chlorinated hydrocarbons. Solutions in all of these solvents are considerably higher in viscosity than are similar solutions of ordinary rosin at equal concentrations. The new resin has not shown crystallization. This quality will make the resin useful in the manufacture of spirit varnishes, core oils and printing inks where crystallization has been a serious problem. Solvent retention of the resin is not appreciably changed, but films obtained from its solutions are harder. Physical properties of the resin are as follows:

Melting point (drop)	98–103 deg. C.
Melting point (ring & ball)	92–94 deg. C.
Acid number	152–156
Saponification number	157–160
Color (U. S. Standard)	WG–X
Refractive index at 20 deg. C.	1.5440
Specific rotation (solid)	+40
Petroleum ether insoluble	7
Ash	0.01%
Viscosity — 60% in toluene (CTS)	20
Density (at 25 deg. C. / 25 deg. C. against water)	1.0740

TRANSPARENT GLASS BUILDING BLOCK

The development of a transparent glass building block that affords almost window-like vision has been announced by Pittsburgh-Corning Corp., Pittsburgh, Pa. The new block called the "Vue" glass block, was developed for specific needs where some outside vision is desired through panels of non-transparent glass blocks. The new block permits sufficient general vision of large objects of movements beyond the panel to prevent a "shut-in" feeling, although the visibility of sharp detail is not possible under most conditions. The block combines the high insulation properties of the usual glass block. It contains a partial vacuum, a dead air space, which results in the glass block panel having approximately the same insulation value as a solid masonry wall 8 in. thick and more than twice the insulation value of ordinary single-glazed windows.

"Weyerhaeuser Introduces 'Chemiclean' Sulphite"

"Aiming to improve unbleached sulphite pulp through chemical cleaning—part of a program to improve quality, conserve timber and increase efficiency."

Pacific Pulp & Paper Industry—Aug., 1941

SEMCO

"The Stebbins Engineering Corporation of Seattle tile lined the continuous reactor, the 8 high density reactors, washer vats, dilution chest, and the low pressure acid accumulator."

Pacific Pulp & Paper Industry—Aug., 1941

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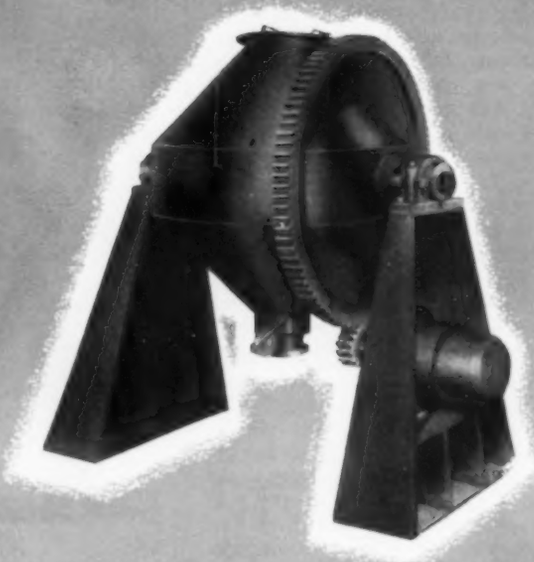

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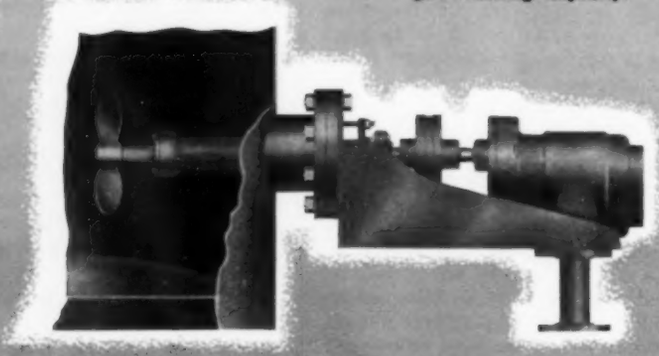
DOUBLE RIBBON MIXER, for fast mixing of any materials from dry powders to heavy pastes. Jacketed or unjacketed, in 21 standard sizes.



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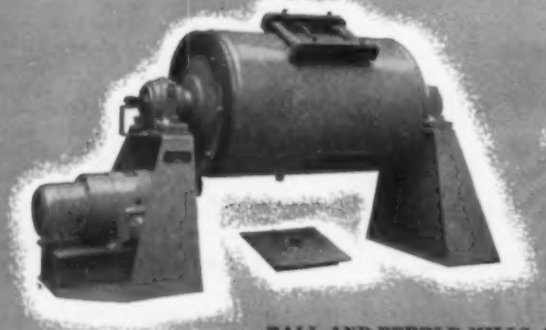

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Exposition of Chemical Industries Attracts Wide Attention

Chem & Met MEETINGS & CONVENTIONS

The 18th Exposition of Chemical Industries, meeting in Grand Central Palace in New York during December 1-6, is the second such exposition held during a war emergency. With priorities of materials and machinery already causing headaches for equipment manufacturers and users, the mere promise of plenty more to come should be sufficient incentive for these two to get together for an exchange of information and experience. The Exposition is the logical opportunity for American chemical industry to make a collective effort toward preparation for the next few years.

CHEMICAL ENGINEERS attending the recent meeting of the American Institute of Chemical Engineers at Virginia Beach were amply rewarded by the large amount of engineering data in the technical papers presented before the sessions. But for those engineers who, for national defense or other reasons, were unable to attend this meeting there have been included in these columns abstracts of some of the more outstanding papers. The remainder will be abstracted in early future issues of this section, together with those presented at other meetings.

WETTED-WALL TOWER DISTILLATION

DATA OBTAINED ON the rectification of ethanol-water in a 12-in. wetted-wall tower 11 ft. high were presented before the American Institute of Chemical Engineers by A. J. Surowiec and C. C. Furnas of Yale University. The column was operated as an enriching section with vapor feed. Liquid velocities were varied between 7.59 and 18.10 moles per sq.ft. per hr. Vapor velocities were varied between 8.94 to 18.10 moles per sq.ft. per hr. Mole fraction of ethanol in entering vapor feed was varied between 0.006 and 0.179. Reflux ratios were varied between 0.705 and infinity.

Data were first correlated on the basis of overall volume transfer coefficients and compared with the coefficients previously obtained on the same apparatus with various packings in the tower. At the higher rates of liquid flow, the overall transfer coefficients per unit of volume were several fold greater than for the wetted-wall column but at the lowest rates of flow, the coefficients were higher when no packing was in the tower.

Throughout the experiments the liquid layer was in viscous flow and the vapor stream in turbulent flow. The relations for the mass transfer coefficients for each film were formulated from analagous functional relations previously published. The individual film coefficients were evaluated from a straight line plot of the reciprocal of the overall coefficient in terms of liquid concentration against the parameter which determines the gas film coefficient.

Individual film transfer coefficients per unit of area were evaluated. For the gas film these were found to be 2.8 times as great as those published for the vaporization of a pure liquid into an air stream.

For the liquid film, the evaluated coefficients were 14.3 times as great as those computed from an analogy to data reported on heat transfer between gas and a liquid layer in viscous flow. A tentative explanation of these large transfer coefficients was given by the authors. The major resistance was in the gas film. Generalized equations were given for the film transfer coefficients, which should apply to the rectification of any binary mixture in a wetted-wall tower, but the exactness of the relations has not yet been experimentally verified.

Computations were made on the performance of an idealized wetted-wall tower consisting of ½-in. i.d. tubes operating in parallel with a rate of liquid flow of 50 lb. per hr. per ft. of tube perimeter, for three different conditions of tower through-put and composition. The computed performance was compared with measured performance of a tower packed with 1-in. Berl saddles. For two of the three cases, a foot of height of the tube bundle was computed to be three times as effective for rectification as the packed column. Although these conclusions have not been experimentally verified, they indicate that, if difficulties of construction and operation could be overcome, a bundle of small wetted-wall tubes should make an efficient unit.

DRYING OF SOLIDS BY THROUGH-CIRCULATION

THROUGH-CIRCULATION DRYING affords the most rapid method of drying solids and hence is of great industrial importance, reported W. R. Marshall, Jr. and O. A. Hougen of the E. I. duPont de Nemours & Co., Inc. and the University of Wisconsin, respectively, before the Virginia Beach meeting of the American Institute of Chemical Engineers. The methods of pre-forming solids for through-circulation were described. The drying-rate curves were similar in shape to those obtained in tray-drying. Shrinkage during drying may be followed by observing changes in pressure drop.

During the constant-rate period, the rate of through-circulation drying with air can be simplified to the form:

$$\frac{dW}{d\theta} = a' G^{0.80}\, \Delta H$$

In the above formula W = lb. water per lb. dry stock; G = mass velocity of dry air, lb. per (sq.ft.) — (min.); $\Delta H = H_s - H_a$; H_s = saturation humidity corresponding to the wet-bulb temperature of air; H_a = humidity of main stream of air, lb. per lb. of dry air.

Values of a' were shown to depend upon the method of pre-forming the

CALENDAR

DEC. 1-6,	**18th Exposition of Chemical Industries, Grand Central Palace, New York, N. Y.**
DEC. 29-30,	**8th Annual Symposium, Division of Industrial and Engineering Chemistry, American Chemical Society, Case School of Applied Science, Cleveland, Ohio.**
DEC. 29-31,	**9th National Organic Chemistry Symposium, Division of Organic Chemistry, American Chemical Society, Ann Arbor, Mich.**
MAR. 23-25,	**American Society of Mechanical Engineers, spring meeting, Houston, Texas.**

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stock and to range from low values for heavy dense solids to high values for light, fibrous solids. The range in values of small a' for various types of materials were given as follows:

Pigments, clays, heavy solids	3–9
Starches, flours, fillers, insecticides	10–22
Granular solids	25–100
Fibers (textile and wool)	110–220

LIQUID-LIQUID EXTRACTION IN WETTED-WALL AND PACKED COLUMNS

EXPERIMENTS WERE REPORTED by E. W. Comings and S. W. Briggs of the University of Illinois and the Gulf Oil Co., Pittsburgh, respectively, before the American Institute of Chemical Engineers in Virginia Beach, on four wetted-wall columns and four packed columns of different dimensions varying from 0.47 to 7.45 in. in diameter and from 4.6 to 46.5 in. long.

Three solutes, benzoic acid, aniline and acetic acid, were transferred between water and benzene phases. Sodium hydroxide and HCl solutions were used to reduce the over-all resistance. Wetted-wall columns less than 1 in. in diameter gave overall coefficients twice those in the packed columns and had capacities per unit area of column cross-section as much as ten times as great. The velocity of the dispersed phase in the packed column had the greater effect on the over-all coefficients and caused the same percentage variations in the resistance in both phases. The velocity of the continuous phase had a smaller effect which was again the same in both phases. Over-all coefficients at a given packed column can be represented by the equation:

$$K_a = V_D V^3_C$$

where V_D is the superficial velocity of the dispersed phase and V_C of the continuous phase.

CLARIFYING EFFICIENCY OF DIATOMACEOUS FILTER AIDS

FACTORS RELATED TO the clarifying efficiency of diatomaceous filter aids were discussed before the American Chemical Society by A. B. Cummins of Johns-Manville, Manville, N. J. The author considered in detail the role of filter aids in "clarification filtrations" and showed certain relationships between types of filter aids and different kinds of suspended particles.

Data were presented to show the correlation between particle size, shape and other properties of a number of diatomaceous silica products and the results obtained in the filtration of liquids containing suspensoid or emulsoid particles of different types. It was shown that two types of colloidal impurities in sugar solutions behaved differently with different types of filter aids.

More fundamental relationships for filter aids were shown by calculations

of particle size, specific surface cake porosity, and in comparing the results obtained in the filtration of particles of known size and electric charge. Filtration tests made with simple dispersoid systems such as carbon black, metallic oxides, oil emulsions and latex emphasized some of the complicated relationships between type of filter aid and degree of clarification.

PACKED TOWER PERFORMANCE AT HIGH LIQUOR RATES

EFFECT OF GAS AND LIQUOR rates upon performance in a tower packed with 2-in. rings was reported upon before the American Institute of Chemical Engineers by C. M. Cooper, R. J. Christl, and L. C. Perry, all of the E. I. du Pont de Nemours & Co.

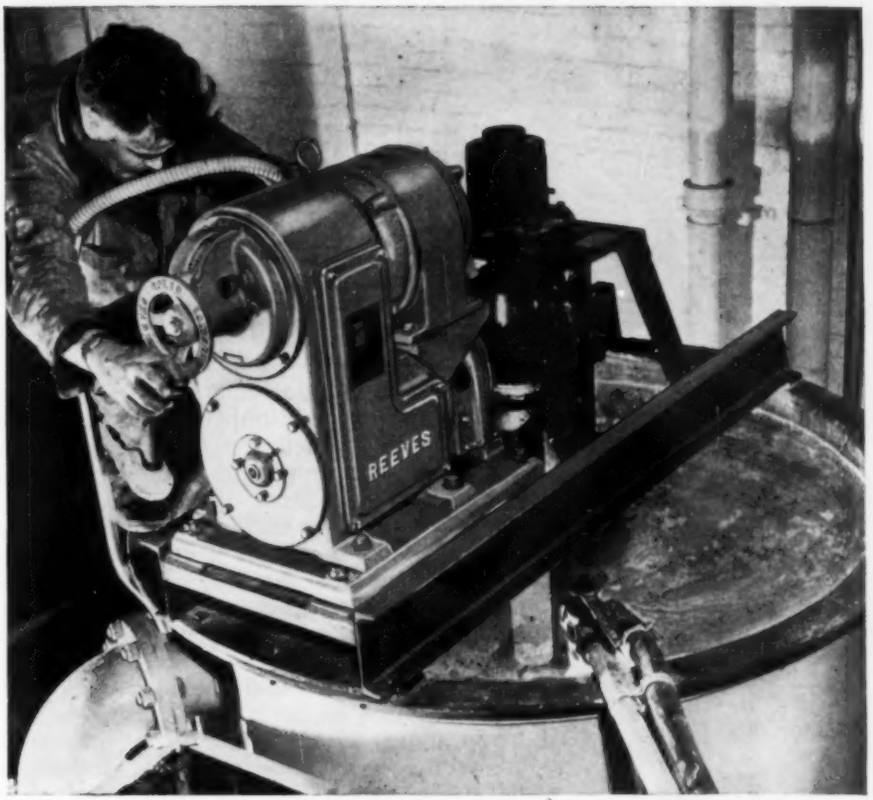
Carbon dioxide was stripped from its water solution by air in a 30-in. square tower filled to a depth of 86 in. with 2×2×1/16-in. steel Raschig rings. Water rates from 13,200–56,000 and air rates from 19-368 lb. per hr. per sq. ft. were employed. At constant water rate the values of $(H.T.U.)_{OL}$ were found to vary with the air rate by as much as two-fold, increasing as the gas velocity decreased.

For all cases in which the gas rate was less than that at which the complete removal of dissolved gas would theoretically be possible in a very tall tower, the values of $(H.T.U.)_{OL}$ exceeded 6 ft. It was shown that calculated average linear water velocities down the column exceed in this range by several fold the average linear gas velocity. This is believed to result in circulation of gases within the column from top toward bottom, thereby altering CO_2 content of the gas from that corresponding to true countercurrent flow in such a way as to reduce the driving forces and give a high value to the $(H.T.U.)_{OL}$ calculated from terminal conditions.

IRON DEPOSITION

APPLICATIONS OF IRON PLATING are very limited at the present. On the other hand, iron electroforming and electrowinning have recently met with renewed interest, reported C. T. Thomas, Bureau of Engraving and Printing, Washington, before the Electrochemical Society in Chicago.

Iron Sulphate Bath—Ferrous sulphate may be used alone or with other salts such as ammonium, magnesium, and sodium sulphates. The double salt, ferrous ammonium sulphate, seems to be the most used. One author recommended a concentrated solution containing 47 oz. per gal. of ferrous ammonium sulphate at about 65 amp. per sq.ft. with a temperature of about 140 deg. This bath should be slightly acid, from 0.01-0.02 *N* H_2SO_4. Good results are claimed for this bath at about a pH of 6 and at the same current density and temperature. For operation at room temperature, a current density



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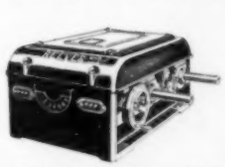
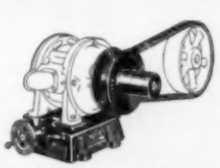
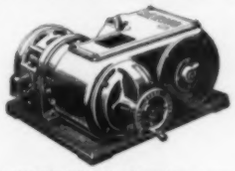


VARIABLE SPEED TRANSMISSION for infinite speed control over wide range—2:1 through 16:1. Fractional to 87 h.p.



VARI-SPEED MOTOR PULLEY for application to shaft of any standard constant speed motor; 3:1 range. To 15 h.p.



MOTODRIVE—Combines motor, variable speed drive and gear reducer (if needed). To 10 h.p., range 2:1 through 6:1.

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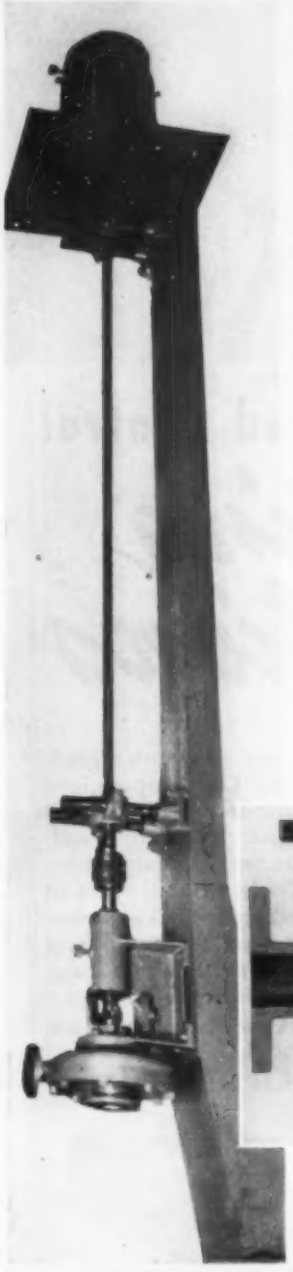
Both builder and user must share the blame when "a pump" proves not to be good pumping practice. Expensive repair, replacement and interruption of service can prove to be costly proof of false economy in buying "a pump" for corrosive liquids, despite its initial lower cost or temporarily higher efficiency. The user is guilty of underestimating his pumping problem, and the builder must answer for selling a unit unsuited for its service.

Quimby engineers have a half century of practical experience to back their judgment that it takes more than "a pump" to guarantee good pumping practice. Design, materials, construction, application, installation and maintenance according to individual specifications of each job must be carefully considered. Both builder and user must maintain constant interest in that pump during its entire useful life. That is why Quimby pumps are not and cannot be "sold off the shelf". That also explains why Quimby pumps consistently last longer and pay higher pumping dividends on your pumping investment. Bulletin C-211 explains these points of good pumping practice in detail.



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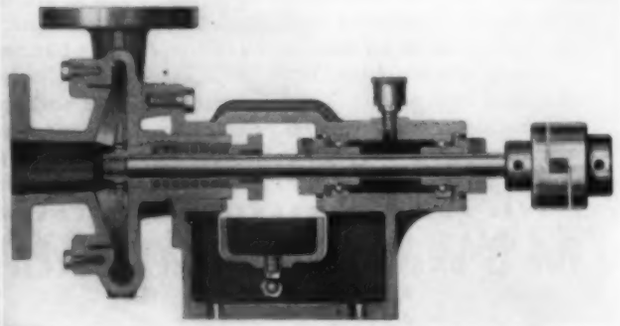


Cross Section of Quimby Centrifugal Pump Type GV and Typical Assembly at Left.

QUIMBY PUMP COMPANY, Inc.
351 THOMAS STREET NEWARK, N. J.

QUIMBY PUMPS

GOOD PUMPING PRACTICE SINCE 1894

of about 19 amp. per sq.ft. is used, with the acidity reduced to about 0.005 *N*.

Ferrous Chloride Bath—Calcium, sodium and magnesium chlorides are frequently added to the ferrous chloride bath. For rapid deposition, a concentration of 53.5-67 oz. per gal. of $FeCl_2.4\ H_2O$ should be used. Brittle metal can be obtained at lower temperatures but for soft deposits the temperature should be 185 deg. F. or higher. For average working conditions a current density of about 60 amp. per sq.ft. and a temperature of 194 deg. F. are used. The bath must be kept slightly acid by periodical additions to maintain an acidity of about 0.01 *N* HCl. Very good deposits can be obtained at current densities as high as 280 amp. per sq.ft. by operating at higher temperatures and acidities.

Anodes—For both sulphate and chloride baths, anodes made of iron of high purity, such as ingot, wrought, or Swedish iron, are preferred. Steel and cast iron anodes have also been used and when run without bags these may be more satisfactory than pure iron because smoother cathode deposits can be obtained. In general, however, it will be found necessary to bag the anodes. For this purpose, woven blue African asbestos has proved to be most satisfactory, although woven glass can be used and some of the new, synthetic textile products show promise. No cases of passivity of iron anodes under plating conditions have been reported, even for high pH sulphate baths.

EXTRACTION OF FATTY ACIDS BY MEANS OF LIQUID PROPANE

PRELIMINARY STUDY of extraction of fatty acids from rosin acid-fatty acid mixtures by liquid propane has shown that there are several types of compounds of high molecular weight, not of petroleum origin, soluble in propane at room temperatures that have a temperature-solubility curve with a negative slope. So reported A. W. Hixson and A. N. Hixson of Columbia University and the University of Pennsylvania, respectively, before the American Institute of Chemical Engineers. For some pure compounds of this group, a phase separation occurs at a definite temperature. Above this point two immiscible liquid phases exist, while below it one exists. The temperature of the phase point varies with the different compounds and with the amount of any particular compound in solution.

Solubility curves for oleic acid and abietic acid in propane were determined. Equilibrium diagrams for the ternary system oleic acid- abietic acid-propane showed that when two liquid layers are formed, the ratio of oleic acid to abietic acid in the upper layer is always higher than in the lower one. By proper adjustment of the concentration at 96.7 deg. C the fatty

acid can be separated in practically the pure state.

Data obtained on the ternary system can be applied to design calculations for several different extraction methods. According to the authors, it appears to be an ideal system for extraction with reflux.

CONTINUOUS NITRATION OF BENZENE WITHOUT SULPHURIC ACID

A NEW PROCESS HAS BEEN DEVELOPED for nitration of benzene without the use of sulphuric acid or other dehydrating agent, reported D. F. Othmer, J. F. Levy, and J. J. Jacobs, all of the Polytechnic Institute of Brooklyn, before the American Chemical Society in Atlantic City. This method can be used for the production of di- and trinitrotoluene and thus can eliminate the necessity of using two parts of H_2SO_4 for every part of HNO_3 needed by present methods.

Simplicity of equipment and operation are attractive features, since the benzene or toluene is fed with HNO_3 into the distilling system; the water of reaction is immediately removed and discarded and the nitro-product is run out in a pure form.

Water of nitration is removed as an azeotropic mixture with benzene. This mixture boils at 69.25 deg. C. The effect of acid concentration upon rate of nitration and the effect of time upon percent conversion using 68 percent HNO_3 were determined. In preliminary runs, the water and benzene removed as an azeotropic mixture contained considerable quantities of acid. Additional length of the distilling column reduced this acid, but the possibility of a ternary system was considered.

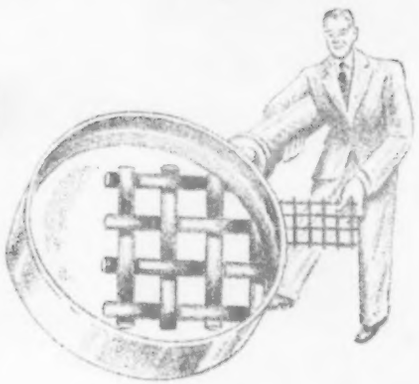
An investigation of the system of benzene-acid-water showed that 68 percent HNO_3 could be fractionated from the benzene-water azeotrope. A series of continuous runs, using a feed of 61 percent HNO_3 was undertaken to determine the effect upon percent nitrated by the variation of benzene to acid ratio, vapor rates, and feed plate position. Further investigations were carried out with a feed of constant boiling HNO_3 vapor. Data necessary for the design of a 2-column continuous system were obtained, which may be operated smoothly due to the large excess of benzene always present.

MULTI-LAYER CONSTRUCTION OF THICK-WALL PRESSURE VESSELS

MULTI-LAYER CONSTRUCTION is a development which has grown out of the uncertainties connected with solid, thick-wall, high-pressure vessel design, reported T. M. Jasper and C. M. Scudder of the A. O. Smith Corp., Milwaukee, before the American Institute of Chemical Engineers in Virginia Beach.

At first these multi-layer vessels were constructed by wrapping the layers tightly by mechanical means. The snug fit produced between adjacent

To Careful Buyers of Screen



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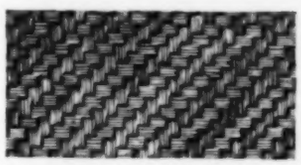
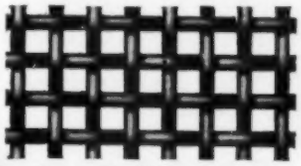
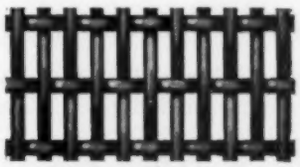


Jersey Stranded Flexible Filter Cloth

Dutch Weave Twilled Filter Cloth



Square Mesh Wire Screen



Oblong Mesh Wire Screen

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VERSATILE PQ SILICATES OF SODA

IF silicate of soda is just "waterglass" to you, ask for a copy of PQ Bulletin #171. Here are described over 30 different silicates, from $3Na_2O$, $2SiO_2$ to Na_2O, $3.9\ SiO_2$. The solutions in this selection range from 33.5° Baumé (Specific Gravity 1.30) to 69° Baumé (Specific Gravity 1.91).

Each of the PQ Brands has been perfected to meet requirements for certain uses; for instance, adhesives, binders, colloids, deflocculants, inhibitors, detergents.

Popular uses of some liquid brands

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PAPER SIZING	"S" Special
ASBESTOS PRODUCTS	"O" Brand
PEROXIDE BLEACHING	Star Brand
COATING WELDING RODS	"N", "U", "K"

APPROXIMATE RATIO OF ABOVE PQ SILICATES: "N" Brand, Stixso NN, "O" Brand, 1:3.22; Stixso DD 1:3.40; "S" Special 1:3.75; Star Brand 1:2.50; "K" Brand 1:2.90; "U" Brand 1:2.40; "C" Brand 1:2.00.

For silicate information, turn to PQ Silicate Headquarters. Specific advices where particular conditions are known.

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layers resulted in a vessel which responded in accordance with the Lame formula for thick-wall cylinder construction.

Recently, multi-layer vessels have been so constructed that the inner layers are subjected to compression and the outer layers are in tension upon completion. When the inside pressure upon the vessel is raised to the working value, the changes in stress combine with stresses already present to produce a more even distribution through the wall than is otherwise possible. Uniform stresses at working pressure allow a design in which working stress × wall thickness = ½ inside diameter × working pressure; in other words, the stress formula:

$$S = \frac{PDi}{2t}$$

In the first instance, the design produced an economical construction when $Dm/t = 5$ or more. With the second method of construction, safe vessels can be economically built for very low values of Dm/t.

CHEMICALS FROM PICKLING LIQUOR AND COPPERAS WASTE

EVERY YEAR OVER a billion gallons of waste consisting of solutions of ferrous sulphate and H_2SO_4 are discarded into streams as a means of disposal, according to H. W. Gehm, N. J. State Experiment Station, New Brunswick, before the American Chemical Society in Atlantic City. These wastes arise mainly from the pickling of steel and the leaching of ores with H_2SO_4.

Two processes for the recovery of useful products from wastes consisting of iron sulphate solution were developed in the laboratory by the author. One consists of the production of Na_2SO_4 of high purity and a sludge free of sulphur which can be returned to the blast furnace for recovery of iron. In this process sodium silicate having a $Na_2O:SiO_2$ ratio of 1:3.14 was added to the hot liquor with agitation. Soda ash was then added, agitation continued for 20 min. and the precipitate filtered and washed. The cake was porous and crumbled readily. An analysis of the dry residue showed that it contained 41.4 percent Fe_2O_3 and 39.1 percent SiO_2. The filtrate contained 16.7 percent Na_2SO_4 which is a saturated solution at 20 deg. C. After evaporation, a Na_2SO_4 of a very pure grade was obtained.

Another process was that of producing $FeCl_2$ from copperas by converting the free acid to iron sulphate with scrap iron and converting the sulphate to chloride with $CaCl_2$. Subsequent chlorination of the $FeCl_2$ produced $FeCl_3$. Recovery of iron was 87 percent or better. Concentration of the $FeCl_2$ solution that could be produced by this process, however, was found to be limited to about 25 percent compared to the 40 percent liquor sold commercially. The calcium sul-

phate filter cake averaged less than 4 percent iron which, however, could be removed by washing with dilute H_2SO_4 followed by water. The resulting white cake was suitable for the production of building material.

FLOODING VELOCITIES IN PACKED TOWERS

COMPARISONS OF VISUAL and pressure drop methods of flooding velocities in packed towers were reported by B. R. Sarchet of the Koppers Co., Pittsburgh, before the American Institute of Chemical Engineers. Maximum throughput of a packed column used for absorption or distillation is limited by the tendency of the column to flood. While considerable data have been obtained on this subject, there appeared to be need of experiments in a glass column of sufficient diameter so that the wall effect would not be important, even with 1-in. Raschig rings.

For this study a glass column 8 in. in diameter and 5 ft. high was used. Pressure drop measurements and visual observations were made at various air and water velocities, up to the flooding point of one and ½-in. clay rings as well as a new type of packing, 1-in. carbon spined rings.

Pressure drops were plotted versus gas velocities on log-log paper for a number of constant water rates. A "curve" made up of three straight-line segments was obtained. At the lower velocities the slope was about 2, at higher velocities it was around 3–4, and at the highest air velocity it became infinite.

Visual observations showed water beginning to build up on top of the packing at a point definitely below the upper break point in the case of 1-in. clay rings and just at this point in the case of ½-in. clay rings and 1-in. carbon spined rings. These results explain why the flooding data of Uchida and Fujita on 1-in. rings, determined by visual observation only, have been found to be lower than other data determined by pressure drop. Flooding data of previous investigators have been correlated with present data on convenient plots.

COUNTER-CURRENT LIQUID-LIQUID EXTRACTION IN A WETTED-WALL TOWER

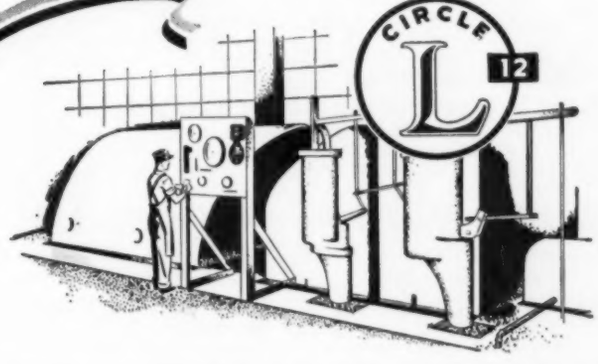
A SERIES OF EXTRACTIONS were carried out with the system acetic acid-water-benzene in a wetted wall apparatus wherein aqueous solutions of the acid saturated with benzene formed the film liquid, and benzene solutions of the acid saturated with water formed the core. Results were reported by R. E. Treybal of New York University and L. T. Work, Metal and Thermit Corp., before the American Institute of Chemical Engineers.

Measurement of the film thickness, made for laminar flow of the film and

SYMBOLS of DEFENSE

MEN from the oil fields of Texas are wearing once more the blue arrowhead of the AEF's 36TH Division. In World War I, this Division included National Guardsmen from Oklahoma as well as from Texas and its combat record reflects the best fighting traditions of the rugged Southwest. Furious assaults by the 36TH vitally assisted the French army to advance at a critical period in the Meuse-Argonne operations. Casualties totalled 2,584. Today, the men of Texas wear the blue arrowhead as one of the proudest battle emblems of the democracy they are prepared to guard against any threat.

Visit Lebanon Booths 465-466 at the Chemical Exposition



PROUD EMBLEM in industry's defense campaign is Circle Ⓛ 12—symbol for Lebanon's 12% to 14% alloy. Its characteristics fit it especially for the handling of hot oil and high temperature steam. Circle Ⓛ 12 is one of the Lebanon alloys which, throughout the years, has made possible changes in methods and practice of far reaching economic value. One or more of these alloys may solve production problems for you. Consult a Lebanon metallurgist.

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turbulent flow of the core during continuous flow of both liquids, showed the interfacial velocity of the film to lie between zero and the maximum in the film.

Overall extraction coefficients were measured under the flow conditions described, and the variations of the coefficient with the average rate of flow in the core and the film relative to the tower wall were studied. The data indicated that the rates of flow of both phases affect the individual extraction coefficients of both film and core, and that neither phase may be said to "control." In view of this, it was not possible to break the overall coefficients down into two individual coefficients, according to the report of the authors.

STATUS OF RUBBER CHEMICALS

THE YEAR 1941 has witnessed the greatest rate of consumption of crude rubber in history, according to J. P. Coe of the Naugatuck Chemical Co., before the American Chemical Society in Atlantic City. The use of supplementary chemicals increased proportionately.

Caustic soda required for annual consumption of 200,000 tons of reclaimed rubber may amount to 15,000–20,000 tons, roughly two percent of the 1940 caustic production for the entire country. Reclaimed rubber manufacture also requires large quantities of motive power, the total for 1941 being of the order of 80,000–100,000 kw. continuously throughout the year.

Aniline—A large number of rubber chemicals are made from aniline and a shortage of this chemical may develop. Production facilities in the United States have been and are being increased but are still considered inadequate for both industry and the defense. Because defense requirements are so large, a shortage in rubber chemicals made from aniline should not come as a surprise to the industry.

Widely-used rubber chemicals derived from aniline include diphenylguanidine and a long list of accelerators made by condensing aniline with formaldehyde, acetaldehyde, butryaldehyde and heptaldehyde. Among the anti-oxidants are condensation products of acetone with aniline and with diphenylamine. Phenylbetanaphthalamine and diphenylparaphenylenediamine start with aniline.

It was stated that a fair estimate of organic chemical usage in rubber is 1.6 lb. of accelerators and anti-oxidants per 100 lb. of crude rubber. This amounts to 20,000,000-25,000,000 lb. in each of the years 1939 and 1940. The aniline required for this production would be between 12,000,000-17,000,000 lb. or 30-40 percent of the total aniline production in 1939.

Zinc Oxide—According to data from the American Zinc Institute, production of Zn in 1941 is 30 percent above 1940, the increase having been taken up

largely by the rubber industry. How long the requirements of zinc for munitions will permit this consumption by rubber will be determined by the strength of the rubber position as presented to the government. One means of conserving ZnO in rubber compounding consists in using zinc in soluble form as in combination with fatty acids. Another proposal is that accelerators be used which require less ZnO for activation, such as those made by certain aldehyde-amine condensations. Economies in the use of ZnO can be effected by the elimination of white sidewall tires.

Formaldehyde — Another chemical important to the rubber industry is formaldehyde, and the use of hexamethylenetetramine as a direct accelerator and as an intermediate in the manufacture of other accelerators is well known. Formaldehyde itself is also required in the manufacture of several important rubber chemicals. Critical need for rubber chemicals will not be decreased by any shift to synthetic rubber. Some types of synthetic rubber do not require accelerators but do require stabilizers and anti-oxidants. Other types require more accelerator or anti-oxidant or both than does natural rubber.

CHEMICAL WARFARE

ALL EUROPEAN BELLIGERANTS are well equipped with chemical agents and are prepared to use them, and this war will never be really "all out" until gases are used on a large scale. So reported Major-General W. N. Porter, Chief of the Chemical Warfare Service, before the American Chemical Society in Atlantic City. When gas warfare will be used depends solely on when Hitler's generals feel that the advantage to them would outweigh any disadvantages.

Best insurance against such gas attacks lies not only in gas masks and protective clothing, but in the ability to retaliate immediately. Hitler undoubtedly knows that the British are well prepared to retaliate and that mustard gas on British beaches would add materially to the precariousness of an invasion. Furthermore, gas is primarily a defensive weapon, and the author indicated that it may be first used when the Germans are put on the defensive. But that it will be used on a large scale in this war at some time is hardly doubtful.

Two years ago there were 109 officers in the regular army on duty in the U. S. Chemical Warfare Service and no reserve officers were available except for short training periods. Today, in addition to the regulars, the C.W.S. has on extended active duty almost 1,000 reserve officers. The C.W.S. School at Edgewood has been expanded during the past year from the usual 200 graduates to more than 1,000.

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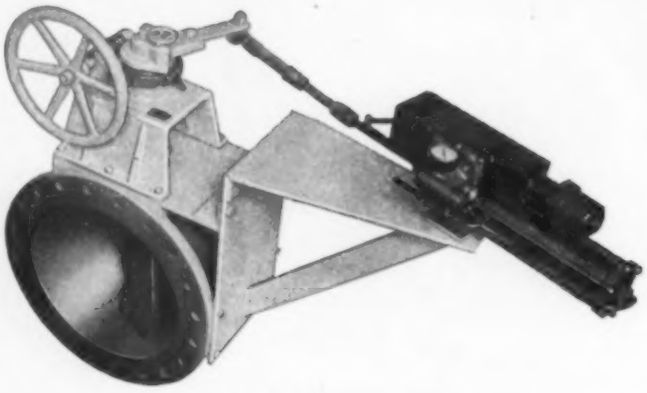

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activities, chemical warfare plants at Edgewood Arsenal have been rehabilitated and many new ones have been constructed. An additional arsenal is now being built at Huntsville, Ala., which will occupy more than 33,000 acres and cost about $40,000,000. This arsenal is expected to be in operation about July 1, 1942.

SYNTHETIC RUBBERS

PRESENT STATUS OF SYNTHETIC rubber in this country was summarized by a recent survey by the U. S. Tariff Commission entitled "Rubber, Possibilities of Producing Rubber in the United States and Rubber Conservation." In 1940 domestic production of synthetic rubber was only about 4,000 long tons. Production in 1941 may be twice that figure and by the end of the year the total productive capacity may be 20,000 tons.

If synthetic rubber is produced from butadiene on a large scale, it will be necessary to expand greatly the production of this material. Plants for manufacturing butadiene would be erected near oil refineries and the butadiene shipped to synthetic rubber plants near rubber consuming centers. It would also be necessary to construct plants for the production of styrene, acrylonitrile or olefins. Styrene or acrylonitrile would require chlorine or nitrogen, both of which are now on the priorities list.

Total cost of plants for production of butadiene, styrene, acrylonitrile or olefins, and synthetic rubber would range from 75-100 million dollars for every 100,000 tons of yearly synthetic rubber capacity. A single plant having a capacity of 20,000 long tons might be erected and equipped in 18 months, but because of the difficulty in obtaining steel and chemical equipment, from 3-5 years would probably be required to construct and equip a sufficient number of plants to supply rubber requirements of the United States.

Members of the trade believe that synthetic rubber could be probably produced in quantity from oil products at a cost of about 25 cents per lb. or perhaps less. The cost of producing crude rubber in the Far East, in the absence of controlled output, is reported at 4-10 cents per lb., and since 1931 prices in New York have ranged from 2¼ to 27 cents per lb.

Tire companies have been experimenting with butadiene types of rubber and have had considerable difficulty in using it. They have found, however, that they can make fairly good tires by mixing synthetic rubber in equal parts with natural rubber (Hevea or guayule).

Germany is using large quantities of butadiene rubber in the manufacture of tires, but the Germans were two years learning how to use it. The cost of producing synthetic rubber in Germany is reported at about 40 cents per lb. Some passenger car tires are made

exclusively from synthetic rubber but the lack of sufficient adhesiveness is understood still to present difficulties in the manufacture of large tires requiring many plies. In the manufacture of some tires, the Germans use synthetic rubber in the treads, reclaimed Hevea rubber in side walls and plies, and Hevea rubber in inner tubes.

ALKYL ESTERS OF PHOSPHORIC ACID

MIXTURES OF PRIMARY and secondary esters obtained by the reaction of the lower aliphatic alcohols with P_2O_5 were discussed before the American Chemical Society by C. A. Hochwalt, J. H. Lum, J. E. Malowan, and C. P. Dyer, all of the Monsanto Chemical Co.

Partial esterification of H_3PO_4 is readily accomplished by reaction of P_2O_5 and the corresponding alcohol or ether to give a mixture of primary and secondary esters. The proportion of esters will depend primarily upon the amount of water present or formed during the reaction. Anhydrous alcohol produces approximately equal molar ratios, although with higher aliphatic alcohols more of the mono-alkyl ester will be formed. Separation of the alkyl esters can be effected by the different solubilities of bariam or calcium salts. Mono-alkyl calcium and barium phosphates are only slightly soluble and can be separated from the easily soluble dialkyl calcium and barium phosphates of the lower alcohols by filtration.

Alkyl esters can also be prepared by reaction of alcohol and phosphorus oxychloride. Interesting products were obtained by the neutralization of mixed mono- and dialkyl phosphoric acids by both organic and inorganic bases. The outstanding property of most of these alkyl phosphates is their high solubility in water. These solutions exhibit low freezing points, good humectant properties, high conductivity and good stability. Furthermore, they are not particularly corrosive.

Since alkyl phosphates are electrolytes which are highly soluble, noncorrosive, and chemically stable, they are very well suited as anti-static agents for the spinning of wool and other fibers. They do not oxidize or discolor on aging. Being water soluble, they are easily removed without the aid of soap. The wide range of properties of the alkyl phosphates as a class makes it possible to select the phosphate best suited for each set of conditions. Alkyl phosphates, particularly the amyl sodium potassium type, seem in no way to alter the particle size of vat pigments adversely, and are every bit as good as glycerine for use as humectants in vat printing pastes.

Ethyl ammonium phosphate is a very good flame-proofing agent and possesses the advantage over inorganic phosphates, such as diammonium phosphate, in that it remains a liquid at lower relative humidity. This means that a

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piece of cloth flame-proofed with ethyl ammonium phosphate is considerably softer in feel.

DISTILLATION IN A WETTED-WALL COLUMN

DATA ON DISTILLATION in a 1.17-in. i.d. wetted-wall column, 6 ft. in length, were presented before the American Institute of Chemical Engineers by H. F. Johnstone and R. L. Pigford of the University of Illinois. Five systems were investigated, including ethanol-water, acetone-chloroform, benzene-toluene, ethylene dichloride-toluene, and benzene-ethylene dichloride.

The apparatus was operated at total reflux on the first four of these binary systems, and as an absorption column on the last two. In the latter case, vapor of the less volatile component was introduced at the bottom of the column, while at the top the more volatile component was introduced as a liquid at molal rates either less than or greater than the vapor rate.

Results indicated that not more than 10 percent of the total resistance to mass transfer in a wetted-wall column lies in the liquid phase. Observed values for the overall resistance are slightly higher than the values for the vapor phase resistance predicted from the von Karman-Sherwood theoretical equation, and fall between values predicted by the correlation of Chilton and Colburn and that of Gilliand and Sherwood. Experimental data for the four systems studied at total reflux and on the absorption of benzene vapors by ethylene dichloride may be represented by the equation:

$$\frac{(H.T.U.)_{ov}}{d} = 7.63\,(Re_v)^{0.23}\,(Sc_v)^{2/3}$$

Data on absorption of toluene vapors by ethylene dichloride indicate that when counter-diffusion occurs under a large difference between boiling points of the two components the apparent values of $(H.T.U.)_{ov}$ vary considerably with the liquid rate. This does not indicate that a major portion of the overall resistance to transfer occurs in the liquid phase, since the transfer process is complicated in this case by passage of the less volatile component into the vapor due to vaporization of the liquid at the interface.

Observed resistance in the liquid phase is considerably lower than would be expected from a theory based on diffusion into a laminar liquid layer. This discrepancy is ascribed to the effects of the wave motion and counterflow of the vapor on conditions at the liquid surface.

CHEMICAL CONTROL OF SLIME IN PAPER MILL WATER

MOST WIDELY KNOWN CHEMICAL treatment for the control of slime in paper mills has been Cl_2 with or without ammonia, reported J. A. Holmes,

National Aluminate Co., Chicago, before the Technical Association of the Pulp and Paper Industry in Ann Arbor, Mich. Organic matter consumes Cl so that in closed systems abnormal dosages may be necessary to obtain any residual. Ammonia sets Cl_2 as a chloramine which is more stable; however, ammonia is very corrosive to copper wires and screens. Some mills use Cl_2 to kill off the bulk of the bacterial slime and then finish off with chlorophenols for spore-forming bacteria and the fungi.

Copper Sulphate—Continuous use of copper sulphate may cause corrosion, especially when total solids of the white water are low. The best use of copper sulphate is in strong solutions for cleaning equipment, tanks, or pipe lines. Sometimes walls of tanks are simply painted with a strong copper sulphate solution.

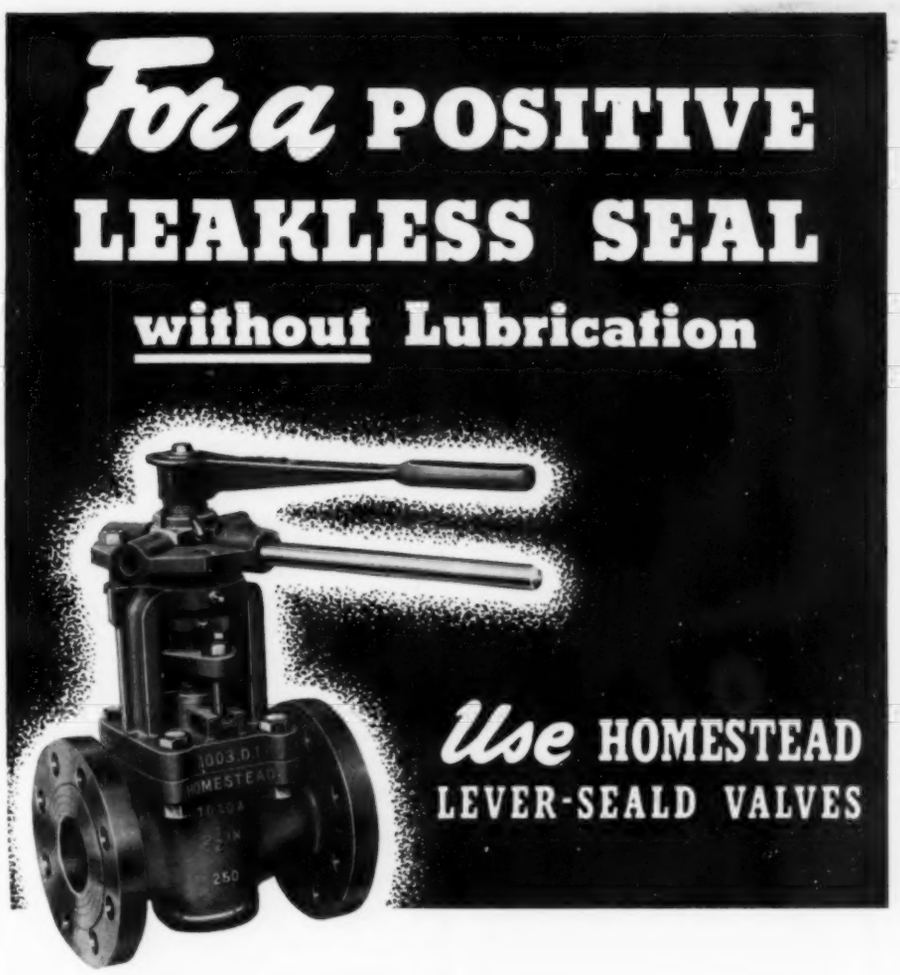
Mercury Compounds—These have been used successfully, although they are rather expensive. Certain of these compounds have killing and inhibiting power with small dosages, sometimes only a few parts per billion being necessary. One bad feature is that too small dosages will stimulate growth of organisms. They should only be used under well controlled conditions.

Chlorophenates—Biggest advantage of the chlorophenates is that they are not used up by organic matter, but tend to concentrate in the system. Sodium pentachlorophenate is best for the spore-formers and certain of the fungi. Its reactions are slower than chlorine and consequently is more suitable in a closed system.

Pentachlorophenol is of advantage when it is desired to retain the chemical in paper for mold-proofing. By adding the pentachlorophenate at the beater, acidity causes its precipitation into the fibers for retention in the sheet. However, in slime control, this condition is highly undesirable because it is necessary to keep and build up the slime-preventing chemicals in the system. Good elimination of mold or fungi organisms from the system by correct slime treatment so reduces the mold count in the finished paper that no direct mold treatment is needed.

Sodium pentachlorophenate has greater inhibiting properties for fungi and about the same for bacteria as pentachlorophenol. 2-chlorophenolphenate is better for the nonspore formers and yeasts than either tetra- or pentachlorophenate.

Methods of Application—Fresh water can be treated with Cl_2 because there is usually sufficient organic material to use up much of the chemical. However, most of the spore-forming bacteria and fungi will not be killed by this treatment. Copper sulphate is beneficial in fresh water especially if there are bases or filters in which algae collect. Chlorophenols are sometimes added to fresh water supplies, especially at rag mills.



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SELECTIONS FROM FOREIGN LITERATURE

VANADIUM IN CAST IRON

FAVORABLE literature data on the effects of vanadium in cast iron led the Iron and Steel Institute in Germany to recommend replacing molybdenum and chromium by the more expensive vanadium. To confirm the merit of the change the technical societies interested in castings conducted a series of cooperative tests. Contrary to the literature, vanadium in cast iron does not improve tensile strength or flexing strength. It cannot replace molybdenum because it gives lower modulus values, not higher.

Vanadium has certain merits in cast iron, but not the ones for which it was recommended. It stabilizes carbide, thereby improving volume stability at medium high temperatures, but above about 750 deg. C. this advantage is more than offset by the unfavorable effect on scale formation. Vanadium increases wear resistance, with respect to sliding friction, hence is useful in engine cylinders.

Digest from "Vanadium in Cast Iron," by E. Piwowarsky, *Chemische Fabrik* 14, 183, 1941. (Published in Germany.)

DRYING

EVAPORATION of water and alcohol from moist materials into air has been investigated in relation to drying problems. Filter stones were used to represent the moist material in hollow cylinders to which water or alcohol was applied from outside while evaporation was measured inside the cylinder. If the surface of the moist material has the same temperature as the cooling interface (as in evaporation of water at high air speeds) the change of state follows the curve of equal interface temperature. When alcohol evaporates into air the vaporization surface is at a considerably higher temperature than the cooling interface, but the change of state follows the same equation as represented in the Mollier i, x diagram, namely: $di/dx = tc$, where i is total heat of mixture of air and vapor, x is lb. water per lb. dry air, t is surface temperature of the moist material and c is the specific heat of the evaporating liquid. When water evaporates into air the ratio of heat transfer to vaporization coefficient agrees with the Lewis law of heat transfer and vaporization, but in the evaporation of alcohol this ratio is about 2.15 times the specific heat of air. Differences between the temperatures of the moist material and the cooling interface as related to air speed are illustrated in the curve chart.

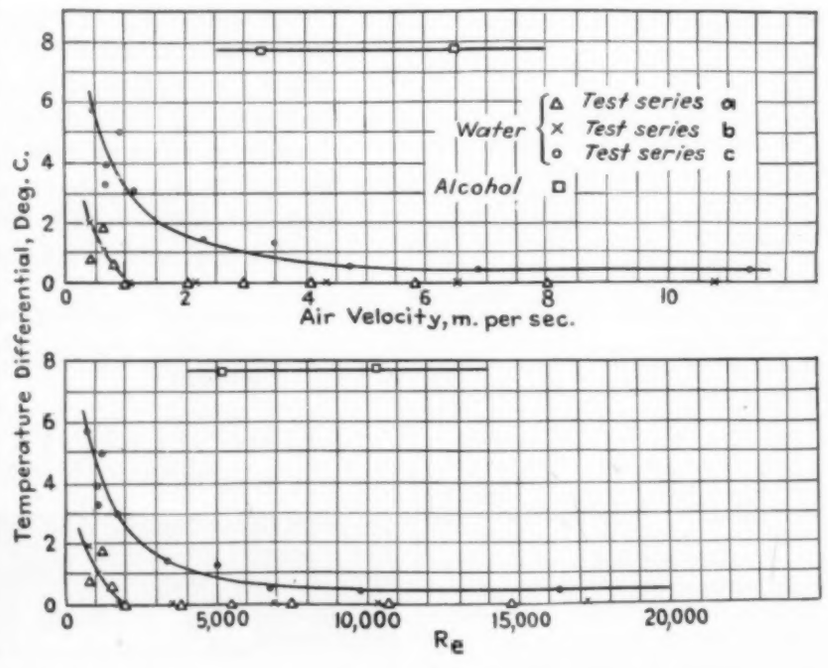
Digest from "Heat Exchange and Material Exchange in Drying Moist Materials," by Emil Kirschbaum and Karl Kienzle, *Chemische Fabrik* 14, 171, 1941. (Published in Germany.)

POROSITY IN TIN BRONZE CASTINGS

BECAUSE of their long freezing range tin bronzes are especially sensitive to dispersed shrinkage and consequent defects, as well as to porosity due to dissolved gases. Most of the damage is done by hydrogen and water vapor, with carbon monoxide and sulphur dioxide as occasional offenders. Carbon dioxide and nitrogen are inert to these alloys. In general the form of a porosity defect is the same for gas pores as for shrinkage, but in grossly unsound castings gas porosity may appear as nearly spherical bubbles.

The reaction between water vapor and a bronze melt is reversible and

Difference between temperature of material and cooling interface temperature as related to air speed or to Reynolds number

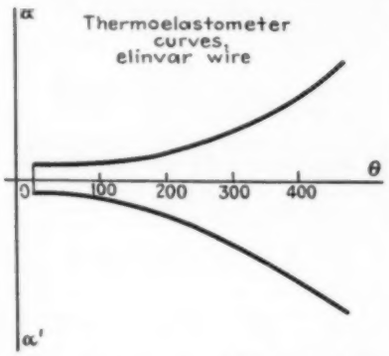


can be controlled to prevent or minimize defects resulting from exposure of melts to a moist atmosphere. This justifies the common practice of melting in a slightly oxidizing atmosphere, but it must be remembered that phosphorus or any other highly oxidizable element, if present, will hinder expulsion of reducing gases by oxidation.

Digest from "Causes of Porosity in Tin Bronze Castings," by T. F. Pearson and W. A. Baker, *Journal of the Institute of Metals* 67, 231, 1941. (Published in England.)

RECORDING THERMOELASTOMETER

A RECORDING thermoelastometer is needed not only for scientific precision studies but also for highly practical problems such as controlling the production of elinvar and other alloys with a specified thermoelastic coefficient. In theory an instrument for recording the temperature:elasticity



curve needs only a single mirror jointly actuated by the tension device and by an expansion pyrometer, but actually gross errors are introduced by plastic deformation and by release of internal stresses. These errors are avoided by causing the load to oscillate between two symmetric constant values, and by heat treatment for equalization of internal stresses. The instrument developed on these principles is used by suspending the expansion pyrometer freely from a wire of the metal to be tested, which is electrically heated and subjected to a specified torsional stress, alternately in opposite directions, by a clockwork mechanism. An additional refinement is the use of two mirrors, placed at such an angle as to form two curves, symmetrically placed above and below the horizontal axis. The curves in the chart were plotted from elinvar after heat treatment (2 hr. at 475 deg. C.)

Digest from "Recording Thermoelastometer," by Pierre Chevenard and Eugene Joumier, *Genie Civil* 117, 32, 1941. (Published in France.)

BACTERIAL GAS PURIFICATION

EXPERIMENTS with peat as a carrier for iron oxide in gas purifiers, to relieve a shortage of iron oxide, unexpectedly gave a much greater purification effect than could be attributed to the mechanical properties of peat. It was found that sulphur bacteria were oxidizing hydrogen sulphide to free sulphur, so actively that peat alone is an efficient purifier for

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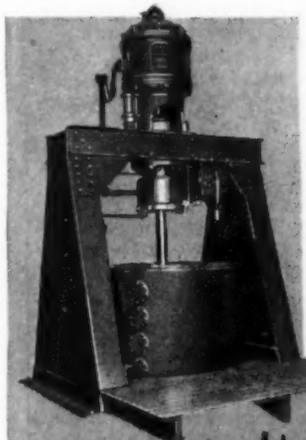

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a considerable time, accumulating about 70 percent sulphur content without any iron oxide at all. In practical gas purification a selected peat, well supplied with sulphur bacteria, is mixed with an equal volume of spent iron oxide. Such a purifier mass has been used successfully in full scale purifier boxes for water gas, and small scale trials indicate that the process will work equally well for coke oven gas. An added advantage is that a peat-oxide mixture is much less sensitive to temperature fluctuations than oxide alone.

Digest from "Bacterial Purification of Gas," by M. P. Appleby and J. Hughes, *Chemical Age* 45, 69, 1941. (Published in England.)

TEMPERATURE INDICATOR PENCIL

HEAT indicating pigments in a wax vehicle, when made up into pencils, can be used to estimate the temperature of a hot surface. The surface to be tested is merely marked with the pencil and in a second or two the pigment undergoes its characteristic color change if the temperature is above the transition point. Heat indicating pencils are now available with transition temperatures 120, 150, 200, 300, 350, 450, 510 and 600 deg. C. Each is banded with its transition color and labeled with its transition temperature. They are made by I. G. Farbenindustrie Aktiengesellschaft.

While heat indicating pencils do not cover a large area, like heat indicating paints, and hence cannot be used for measuring heat distribution or plotting isotherms, they offer the great convenience of an immediate indication. They are useful in handling printing forms, in molding plastics, in processing light metals and in other processes involving heat.

Digest from "Heat Indicating Pencils," by F. Jantsch, *Chemische Fabrik* 14, 196, 1941. (Published in Germany.)

SWELLABILITY OF CLAYS IN FOUNDATIONS

SOIL chemistry has important contributions to offer in highway construction and in laying foundations for buildings. Colloidal clays such as bentonite may be so finely divided that a few hundredths of a percent of the clay will contribute more in surface area of particles than does all the remainder of the soil. The flaky structure of bentonites and kaolins gives them enormous area and remarkable swelling capacity. Particles examined under the electron microscope, at magnifications up to 60,000, reveal extreme thinness. Some flakes are only about one millimicron thick. This structure, coupled with the capacity of colloidal clays to form calcium derivatives, or other derivatives, by base exchange offers a variety of opportunities for utilizing bentonites or kaolins, or for guarding against them when their enormous swelling capacity is objectionable. Thus, kaolinite soils cause severe frost heaves

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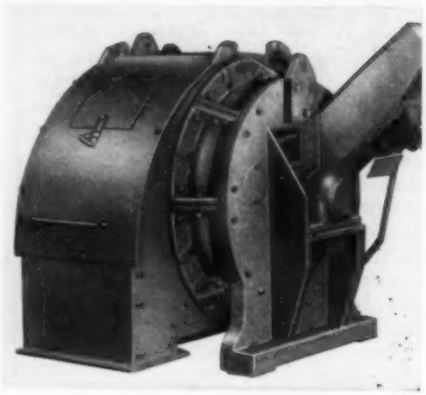

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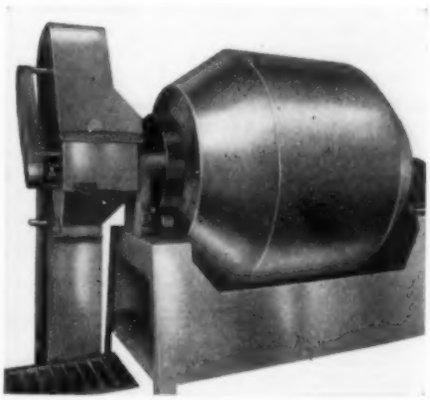

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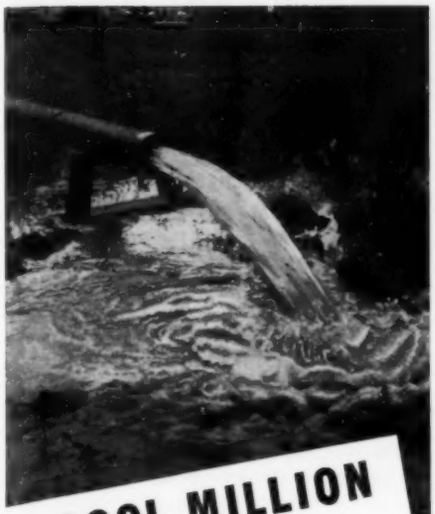

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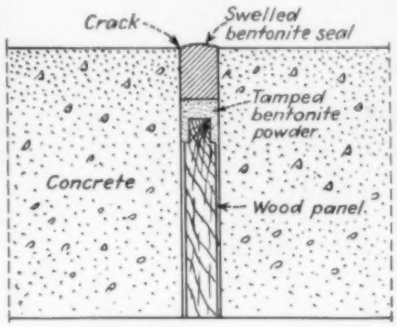
International Water Supply ..... London, Ontario, Can.

in highways but soils with 15-25 percent or more of bentonite are immune to frost heaves and show frost damage only after a few years of accumulated winter cracking in the soil. Both need a frostproof layer but the layer must be adapted to the type of frost damage. Electrochemical soil fixation is a promising development which has not yet been reduced to practice. Sodium bentonite, after swelling in water, is completely impermeable and is useful



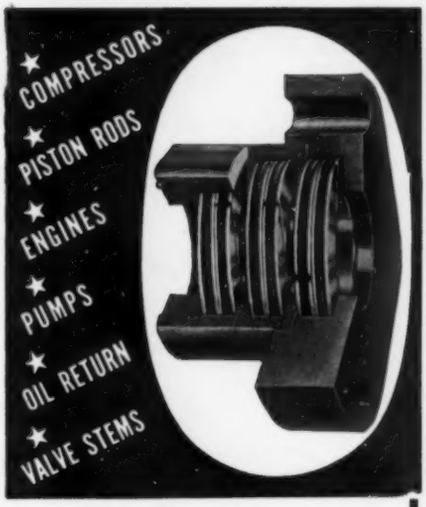
Bentonite-sealed concrete

for sealing cracks in a variety of structures, and for sealing underground storage containers, dams, dikes and the like. The drawing shows a bentonite crack seal.

Digest from "Swellability of Clays in Foundations and its Significance in Construction by K. Endell. *Bautechnik* 19, 201, 1941. (Published in Germany.)

SURFACE PROTECTION OF METALS

CORROSION, whether intercrystalline or proceeding by uniform surface attack or by pitting, is sometimes more economically controlled by surface treatment than by use of a resistant alloy. Metal to be coated is not always thoroughly cleaned, degreased and freed from scale or traces of previous coatings. Neglect in this respect causes many failures, especially since surface defects such as pores and occlusions are not rendered harmless by being covered. Again, it is often not recognized that the after-treatment is quite as important as the pretreatment, especially in applying inorganic protective films from aqueous solutions. The two foremost precautions after the film is deposited are rapid drying and complete removal of residual electrolyte. Each method of coating with a metal or an oxide has its limitations but the range of available methods is ample to cover any case of needed protection. The diffusion method (from metal powder or a salt) is especially useful for coating iron with zinc (sherardizing), aluminum (alitizing) or chromium (incromizing). Clad metals, with protective metal rolled onto one or both faces of a base sheet, are now successfully produced with copper, nickel, silver, aluminum or special alloy steel films on iron, or aluminum, aluminum alloy or copper on aluminum or aluminum alloy sheets. Fusible metals, if not too toxic, can be applied by the spray



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gun method or dipping the base sheet in a melt of the protective metal as in tinning, galvanizing, lead coating or aluminum coating sheet iron. Oxide or salt films applied by anodic oxidation or by phosphate or chromate treatment are effective alone, or serve as excellent foundations for corrosion-resisting paints. Unlike aluminum, magnesium cannot be protected by oxide films of the Eloxal type because magnesium oxide has a smaller volume that the free metal instead of larger and it lacks the hardness which makes aluminum oxide effective on aluminum. Magnesium and its alloys are therefore protected by treatment with an acid solution of a soluble chromate. Some magnesium alloys can be oxide-coated by anodic oxidation but the porosity of the oxide film is such that a pore-sealing finish coat such as a baking enamel is needed for full protection.

Digest from "Surface Protection of Metals," by W. Wiederholt, *Zeitschrift des Vereines deutscher Ingenieure* **85**, 451. 1941. (Published in Germany.)

IMPROVED FLUOROMETER

A SIMPLE and relatively inexpensive photoelectric fluorometer has been developed which eliminates the cost of a galvanometer by utilizing a vacuum type photoelectric cell. This is possible because the photocell can be used as a null indicator. The instrument involves principles which are adaptable to other fluorescence measurements, but was designed specifically for extremely sensitive vitamin B_1 assays by determining thiochrome (an oxidation product of the vitamin).

Light from a commercial high pressure mercury arc lamp is divided in two beams at right angles. One has all but the UV light filtered out and the UV beam is used to excite the fluorescent solution. The UV light is then filtered out so that only the fluorescent light actuates the photoelectric cell. The second beam is also filtered and the remaining UV beam is polarized and analyzed by Nicol prisms adjusted by a worm year. It then passes to a second photoelectric cell. Any difference in the photoelectric currents is registered on an electric eye, by connecting the two photocells to an amplifier in opposition. Thus no galvanometer is needed. The instrument is so sensitive that it will detect thiochrome concentrations as low as 5 gamma per liter, yet it is stable enough for use at much higher concentrations.

Digest from "A Photoelectric Fluorometer," by A. H. Woodcock, *Canadian Journal of Research* **19D**, 253, 1941; also published as NRC No. 1009, National Research Council, Ottawa, Ontario.

REGENERATING SPENT LUBRICATING OILS

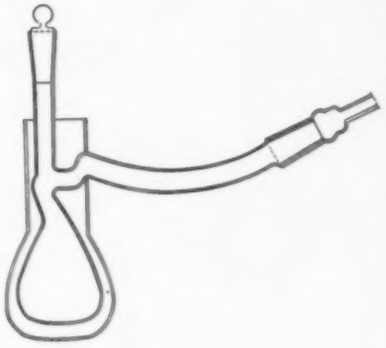
SPENT lubricating, cutting and insulating oils are not effectively regenerated merely by freeing them from suspended solids. They become contaminated with asphaltic impuri-

ties and organic acids which demand specialized chemical or physicochemical refining methods. To be both effective and profitable the treatment must be on a tonnage basis; small scale refining is too expensive if done thoroughly. Insulating oils present a special problem because of the oxidizing and polymerizing effects of arc discharges. The necessary operations in regenerating spent lubricants include centrifugal clarification, treatment with a decolorizing clay or other solid adsorbent to remove coloring matter and other impurities, polymerization of asphaltic impurities with the aid of aluminum chloride or stannic chloride and removal of the polymers, and distillation of the refined oil. In the case of insulating oils absolute freedom from moisture is important since as little as 5 parts per million noticeably impairs the electrical properties of the oil.

Digest from "Aging and Regeneration of Lubricating Oils," by C. Berthelot, *Genie Civil* **117**, 7, 1941. (Published in France.)

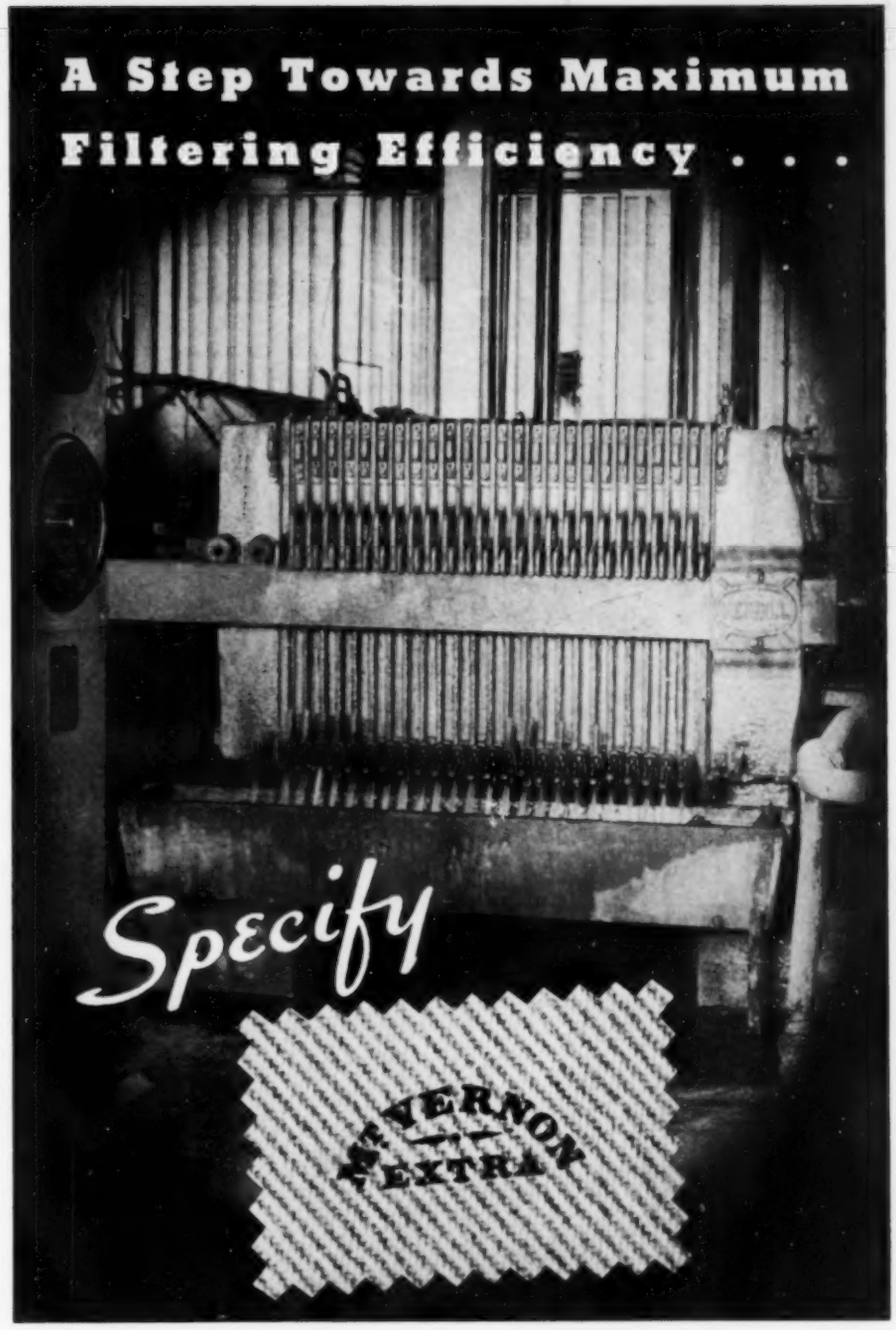
HIGH VACUUM DISTILLATION

IN DISTILLING heat-sensitive substances under a high vacuum the actual distillation temperature depends on the intensity of air cooling at the neck of the flask as well as on the pressure indicated by the manometer. To overcome the reflux condenser effect an improved flask has been designed in



which the ordinary saber flask is enclosed in an outer flask which may be filled with a liquid bath to prevent air cooling. A substance which boils at 200 deg. C. in high vacuum in an ordinary saber flask will boil at about 150 deg. C. in the new jacketed flask. For higher boiling liquids the difference is still greater. The fractionating effect is not seriously impaired. The jacketed flask may be used either to distill out the last trace of volatile liquid from residues, or to effect mild fractionation at a somewhat higher temperature, according to the height of the bath liquid. As shown in the drawing, the flask is also improved by shaping the neck like a short Claisen bulb attachment, which prevents spattering of the boiling liquid into the side arm.

Digest from "Improved Saber Flask for Vacuum Distillation," by W. Schmitt and G. Coutelle, *Chemische Fabrik* **14**, 200, 1941. (Published in Germany.)



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APPLIED THERMODYNAMICS

THERMOCHEMICAL CALCULATIONS. By *Ralph R. Wenner*. Published by McGraw-Hill Book Co., New York, N. Y. 384 pages. Price $4.

Reviewed by *G. F. Kinney*

CHEMICAL engineering thermodynamics needs this latest addition to its literature. This is a comprehensive study of methods. The presentation is largely by solved problems; unity is provided by results rather than by the details of the calculations. The philosophy of the approach is that the answer justifies the method, whether the method involves statistical and quantum mechanics, a semi-empirical estimate, or just a plain ordinary guess. The treatment assumes that "the reader has already been exposed to some formal exposition of the principles of thermodynamics." A review of these principles is included, along with certain amounts of tabulated data on entropies, heat capacities, Einstein functions, etc., all of which are required for some of the problems.

The first part of the book is called "Principles," the last part, "Applications." Typical problems considered include estimation of solubility, possibility of producing benzaldehyde from benzene and carbon monoxide, theoretical propane flame temperature, the decarburization of ferrochrome with calcium, and problems connected with liquefaction of gases and with fluid flow when it is accompanied by a large temperature drop. Sixty unsolved problems are included in an appendix. Some of these would seem to require considerable literature search to find requisite data.

There is a good index, and the subject matter is divided into numbered sections. Over 200 references are listed (this count includes a desirable repetition). Standard nomenclature is used, a table of which might have been included for that occasional reader who has difficulty remembering the many conventional abbrevations.

This book could well be used as a text for a graduate course in chemical engineering thermodynamics, and as a thorough treatment of applied thermodynamics it is a "must" for the chemical engineer who needs a summary of the present state of the art.

THE PRACTICAL APPLICATION OF ALUMINIUM BRONZE. By *C. H. Meigh*. Published by McGraw-Hill Publishing Co., Ltd., London. Available from McGraw-Hill Book Co., New York, N. Y. 112 pages. Price $4.

IT IS gratifying to see that, in spite of national preoccupation with more urgent matters, text and reference books as well as magazines are still being written and published in Great Britain. This example, well bound, profusely illustrated and on excellent paper, will be a welcome addition to the literature of a comparatively new group of materials.

Aluminum bronzes have high tensile strength as an outstanding advantage and they also exhibit satisfactory resistance to attack by sea-water. Among other advantages are resistance to fatigue, wear and abrasion. Among numerous recommended applications are evaporator bodies, condenser tubes and water pumps, valves, crusher rolls and marine uses such as deck fittings, binnacle bodies and propellers. The book's seven chapters cover properties and uses, microstructure, mechanical and physical properties, foundry practice, wrought aluminum bronze, workshop practice, and faults and failures. Numerous photomicrographs illustrate the discussion and charts showing the influence of alloying elements are given in an appendix. Tables of physical properties, many of which compare properties of aluminum bronze with those of other common metals and alloys, are also included.

DECOLORIZING CARBON

ACTIVE CARBON, THE MODERN PURIFIER. Fourth Edition. By *John W. Hassler*. Published by Industrial Chemical Sales Div., West Virginia Pulp and Paper Co., New York, N. Y. 160 pages.

THE ORIGINAL purpose of this useful book was to collect into an organized text knowledge regarding the commercial applications of decolorizing types of active carbon. This revised edition follows the same scheme and does not deal with certain applications for which the gas adsorbent types are especially adapted. The book consists of six general divisions: (1) general approach and introduction; (2) detailed description of applications for various industries and products; (3) physical and chemical behavior of active carbons and methods for their evaluation; (4) bibliography; and (5) properties of Nuchar Active Carbons and their applications. The publication is especially valuable to chemical engineers and industrial chemists because of the practical nature of its information, a large proportion of which has been obtained directly from the trade, use of engineering data in the form of flow sheets, drawings, photographs and tables, and because of the excellent and extensive, easy-to-use bibliography.

ORGANIC SYNTHESES. Vol. 21. Edited by *Nathan L. Drake*. Published by John Wiley and Sons, New York, N. Y. 120 pages. Price $1.75.

PUBLISHED annually, the volumes of this series give explicit directions for the laboratory preparation of various organic compounds. Volume 21 contains directions for 37 such compounds and for Raney nickel catalyst. Among the compounds for which procedures are given are acetoacetanilide, cholestenone, ketene dimer, methylthiourea, resacetophenone and tetranitromethane. All procedures have been checked. Under each are given equations, directions, notes on the preparation and literature references to other methods.

CHEMICAL PROPERTIES OF ENGINEERING MATERIALS. By *F. A. Rohrman*. Published by Edwards Brothers, Ann Arbor, Mich. 102 pages. Price $1.50.

THE AUTHOR, a member of the staff of the department of chemistry and chemical engineering at Michigan College of Mining and Technology, points out that the purpose of this text is to present to sophomore or junior students a study of corrosion phenomena as applied to metals and alloys and a study of the chemical resistance of the non-metallic materials of construction. The subject matter is covered under four chapters: (1) theory and factors affecting corrosion, (2) the chemical properties of the ferrous materials, (3) the chemical properties of the non-ferrous metallic materials, and (4) the chemical properties of the non-metallics.

The text emphasizes the reasons for corrosion of materials and does it in simple and straightforward terms that should be easily understood by the college student. Also, this book should admirably serve the non-technical man who wants to obtain an understanding of the factors affecting corrosion of metals and a knowledge of the usefulness of metallic and non-metallic materials of construction.

MINERALS DURING 1940

THE MINERAL INDUSTRY DURING 1940. Volume 49. Edited by *G. A. Roush*. Published by McGraw-Hill Book Co., New York, N. Y. 778 pages. Price $12.

IN SPITE of world conditions, the present volume of this authoritative source of information on statistics for the mineral industries has succeeded in including valuable data from foreign sources on production, prices and trade conditions. The list of 35 well-known contributors covers both major and

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minor commercial minerals. In addition, there is a valuable summary chapter on the world mineral industry in 1939 and one on recent developments in equipment and unit operations for ore dressing and coal washing. A final chapter gives detailed production and trade statistics for individual countries.

ANALYTICAL CHEMISTRY OF INDUSTRIAL POISONS, HAZARDS AND SOLVENTS. By *M. B. Jacobs*, Published by Interscience Publishers, Inc., New York, N. Y. 661 pages. Price $7.

ON ENCOUNTERING a book such as this, one finds it difficult to evaluate because of the almost overwhelming amount of data contained and the broad range of subjects covered. As shown by the footnote references appearing on nearly every page, Dr. Jacobs has collected information for this one volume from more than a thousand reference sources. He has extracted his analytical procedures from many of these and therein will probably lie the value of the book, since it will quickly furnish accepted procedures for practically any dangerous industrial material.

The book opens with a general discussion of industrial hygiene and industrial poisons, sampling, measurement of gas volume and quantity, absorbers and absorbents, followed by chapters on dusts and silica. Of the metals, lead, mercury and arsenic share one chapter, and one is devoted to 15 others such as chromium, selenium, zinc and copper. Oxygen and ozone are included as, of course, are the poisonous compounds of sulphur, phosphorus, nitrogen and the halogens.

Of the 615 pages of text, nearly half are devoted to the compounds of carbon. Aliphatic, aromatic, and halogenated hydrocarbons each have a chapter. Three other chapters are: Alcohols, glycols, and ethers; acids, esters, aldehydes and ketones; and phenolic compounds, aniline and derivatives.

CIVIL AIR DEFENSE. By *A. M. Prentiss*. Published by Whittlesey House, New York, N. Y. 334 pages. Price $2.75.

THIS new book by the author of "Chemicals in War" should be of interest to every intelligent American, since it is both a timely and detailed study. Its purpose is to examine and analyze situations that would arise in aerial warfare and to prepare the civil population with measures for overcoming such situations. However, the author's attitude is so balanced, the facts are so simply stated and well organized, and the suggestions of such a practical nature, that both technical men and laymen can well use the book as a reference. It is also illustrated with many excellent explanatory diagrams.

The chemical engineer will be particularly interested in the chapters on protection against high explosive and

incendiary bombs, and gases, on decontamination of clothing and buildings, on fire precautionary measures, organization of air raid precautions personnel, and on protection of industrial establishments. The methods described are based upon the most recent practice in Europe. Lt. Col. Prentiss has been associated with the Chemical Warfare Service since 1917 and is one of the leading authorities on the subject.

DIFFUSION IN AND THROUGH SOLIDS. By *Richard M. Barrer.* Published by The Macmillan Company, New York, N. Y. 464 pages. Price $6.50.

Reviewed by *F. C. Nachod*

DR. BARRER'S book brings out the relation of diffusion to chemical kinetics and to sorption and solution equilibria. In the first two chapters, the reader is made familiar with various solutions of the diffusion equation and different types of molecular flow in capillary systems. From there on the text leads to gas flow through crystals, glasses, metals, non-metals, to diffusion of ions in ionic crystals, to interdiffusion of metals and to the relation between conductivity and diffusion constants. Chapter 8 deals with surface phenomena; chapters 9 and 10 conclude the text with permeation solution and diffusion of gases and vapors through organic polymers.

Experimental methods are given as well as their mathematical and physical interpretation. A great amount of data and literature references at the end of each chapter make the book more valuable. No typographical errors were found, and the printing is excellent. The book can be recommended to the student for post-graduate work, to the teacher for reference, and to the technical man for valuable information.

TEMPERATURE MEASUREMENT AND CONTROL. By *Robert L. Weber.* Published by the Blakiston Co., Philadelphia, Pa. 430 pages. Price $4.

LAST March, a paper-bound and lithoprinted edition of this book was reviewed on these pages. The new edition, printed and durably bound, contains essentially the same material. There have been a few minor revisions scattered throughout the text, two new chapters have been added to the section of experiments, and several new tables have been included in the appendix.

HOW TO MAKE A MORALE SURVEY. By *Eugene J. Benge.* Published by National Foremen's Institute, Deep River, Conn. 64 pages. Price $7.50.

IN NORMAL times the morale of workers is of extreme importance to the well-being of any plant or industrial organization. But in times of national emergency, the effect of worker morale extends far beyond mere industrial relations which are reflected in a com-

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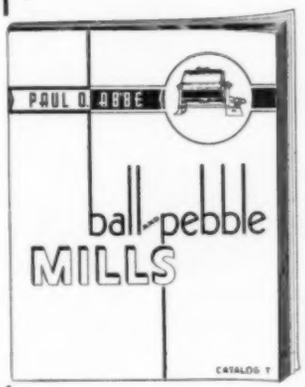

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pany balance sheet. It becomes of national importance.

After defining morale and discussing its importance, this manual's chapters cover in considerable detail questionnaires, making of the study, analyzing results and applying the findings. A series of case studies, bibliography and index are included. Numerous illustrations of questionnaires, posters and graphical results are also given.

As is pointed out in the manual, morale is a term that is loosely tossed about by many executives who have little understanding of what it is and what it can do. The book is recommended to all those seriously interested in labor and management problems.

QUALITATIVE ANALYSIS. Third Revised Edition. By *H. V. Anderson* and *T. H. Hazelhurst.* Published by Prentice-Hall, New York, N. Y., 266 pages. Price (trade) $3.70, (school) $2.75.

THE REVISED edition of this excellent elementary textbook, well-organized in subject matter and format, is recommended for beginner laboratory and lecture courses for three good reasons: (1) the liberal use of appropriate illustrations and analogies makes the theoretical material interesting and easily understandable; (2) semimicro methods are introduced, but not stressed, by special notes and the inclusion of quantities in bold-face type; (3) analytical procedures are used more as illustrations of chemical principles and reactions than as abstract technical exercises in analysis.

MOLDING TECHNIC FOR BAKELITE AND VINYLITE PLASTICS. Published by the Bakelite Corp., New York, N. Y. 224 pages. Price $3.50.

ALTHOUGH this is a fourth edition, previous editions have had limited distribution only. Decision to make it generally available resulted from numerous requests for the textbook. Attractively presented, the data and information in the 14 sections of this book cover technical aspects from materials and principles through finishing and inspection. Sections on plant layout, cost accounting and miscellaneous tables are included.

HANDBOOK OF MICA. By *Ramani Ranjan Chowdhury.* Published by Chemical Publishing Co., Brooklyn, N. Y. 340 pages. Price $6.

ALTHOUGH the author of this "Handbook" naturally deals with the subject primarily from the viewpoint of those interested in the mica industry of India, there is much information, both technical and satistical, on mica and its uses in the United States and in other countries. One section of the book gives interesting data on the geological aspects of deposits, physical characteristics, and chemical composition of the different types. Another gives details of prospecting and development, mining and problems of wastage

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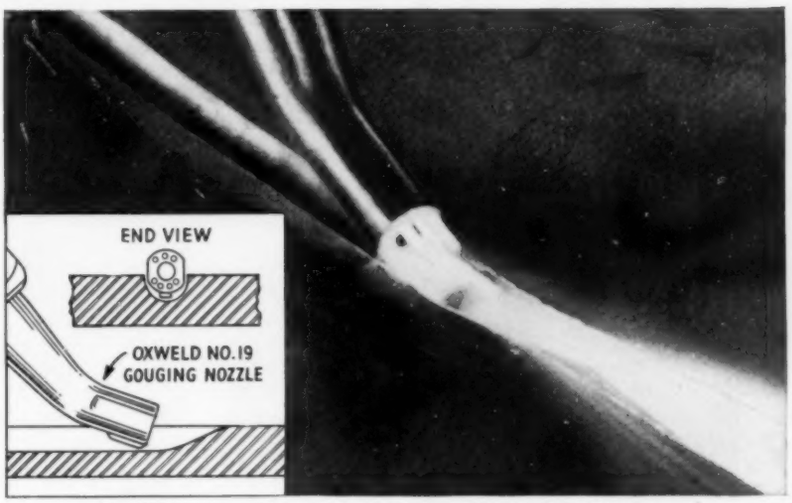
Write for descriptive literature—if you want to know more about this process, write for "Flame-Gouging, An Economical Method of Grooving Steel." A copy will be sent without obligation.



The illustration and sketch show an Oxweld No. 19 gouging nozzle making a groove $\frac{3}{16}$ in. wide and $\frac{1}{4}$ in. deep in steel plate.

A Few Typical Uses

In the construction of tanks, a typical sequence of operations is shown above. Machine-cut plate edges (1) are welded as in (2), then gouged as in (3), for the back-up weld (4).

In preparing steel for welded fabrication, mechanized gouging with Oxweld machines is often used.

One user reported that he makes liquid-level gauges by gouging a channel in steel plate, then facing it with glass.

Studs temporarily welded on to steel pipe, to hold a testing head, were easy to gouge off with Oxweld equipment.

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while a third describes the occurrence and distribution of mica in India, United States and other countries.

Of more interest to the engineer are the sections that deal with methods and peculiar problems in the wet and dry grinding of mica, the manufacture of blocks, splittings and film, gradings, specifications and testing, and process of manufacturing built-up mica. Also of value are those sections on the utilization of mica and mica products in the rubber, paint, roofing, wallpaper, lubricating and other industries. The chapter on the electrical uses of mica also contains helpful engineering data. Importers and dealers in this commodity will be particularly interested in the section on the technique of marketing mica, aspects of the international trade, present and future outlook for the Indian industry, specifications, tariff regulations, and prices.

For those who are now stimulated to prospect for workable deposits of sheet mica, for concerns which mine mica or recover it as scrap from processing operations, for the users of the mineral in any of its forms, and for dealers in the commodity, this handbook should prove of considerable value. In addition, it will prove of interest to all persons concerned with the minerals and processing industries as well as those in the electrical industry.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

Statistics of Income for 1938—Part 1. Compiled from individual income tax returns, fiduciary income tax returns, estate tax returns and gift tax returns. Bureau of Internal Revenue; 30 cents.

Agricultural Experiment Stations. Annual report for 1940, prepared by Office of Experiment Stations, Department of Agriculture; 25 cents.

Agriculture Department Publications. A summary of all Department of Agriculture publications, prepared by Fred L. Zimmerman and Phyllis R. Read, giving title, author and date, arranged by serial number of the publication. 929-page paper bound volume. Miscellaneous Publication No. 450; $1.75.

Regulations of the Secretary of Agriculture Governing Cotton Fibre and Spinning Tests under the Act of April 7, 1941. Promulgated August 25, 1941. Obtainable without charge at Agricultural Marketing Service, Department of Agriculture, Washington, D. C.; mimeographed.

Forest Resources of the Upper Peninsula of Michigan. Miscellaneous Publication No. 429, U. S. Forest Service, Department of Agriculture; 20 cents.

Interstate Petroleum Pipe Lines. Hearings of June 23 and 27, 1941, before subcommittee of the Committee on Interstate Commerce, U. S. Senate, 77th Congress, 1st session, on H.R. 4816, an act to facilitate the construction, extension or completion of interstate petroleum pipe lines related to national defense, and to promote interstate commerce; 15 cents.

The Interstate Commerce Act, together with text of certain supplementary acts and related sections of various other acts (with appropriate cross references to the U. S. Code), revised to April 1, 1941; 35 cents.

Freight Commodity Statistics, Class I, Steam Railways in the United States, year ended December 31, 1940. Interstate Commerce Commission, 151-page document; 75 cents.

Suggested Research Topics in the Fields of Business and Economics. Mimeographed list of 146 proposed research topics in the fields of business and economics, prepared by the Department of Commerce in cooperation with the National Conference of State University Schools of Business. The list is made up primarily of titles relating to national defense and post-war conditions, the purpose being to supply faculty, research staff members and graduate students in colleges and universities of research studies which appear important to our national economy. Obtainable without charge at Department of Commerce, Washington, D. C., or any of its field offices.

Narcotic Regulations. Regulations No. 6 relating to the seizure, forfeiture and disposition of vessels, vehicles and aircraft used to transport narcotic drugs, etc., effective September 25, 1939. Bureau of Narcotics, Treasury Department; 5 cents.

Traffic in Opium. Report of the Government of the United States on traffic in opium and other dangerous drugs, for the calendar year ended December 31, 1940. Prepared by the Commissioner of Narcotics, U. S. Treasury Department, in accordance with article 21 of the Convention of 1931 for Limiting the Manufacture and Regulating the Distribution of Narcotic Drugs; 25 cents.

National Labor Relations Act. Rules and Regulations, Series 2, as amended, of the National Labor Relations Board, effective April 22, 1941; 10 cents.

Federal Power Commission Laws and Hydroelectric Power Development Laws. Compilation by Elmer A. Lewis, Superintendent of Document Room, House of Representatives, of power laws from time of creation of the Federal Power Commission through the 74th Congress; 15 cents.

Priorities Orders. A tabulation of "M" orders, "P" orders, "E" orders, and "L" orders up to September 25, 1941, by the Division of Priorities, Office of Production Management, placing the distribution of various commodities under industry-wide control. Designated as PM-1237, obtainable without charge from Division of Information, Office for Emergency Management, Washington, D. C.

Job Descriptions for Industrial Service and Maintenance Jobs, 1939. 265-page document prepared by the U. S. Employment Service for use of public employment offices and related vocational services; $1.50.

Until the Doctor Comes, by Dr. James A. Dolce, Simple emergency measures. Public Health Service Miscellaneous Publication No. 21; 10 cents.

Bactericidal Effect of the Paraffining of Paper Board Used for Paper Milk Containers, by Frederic J. Moss, Robert C. Thomas, and Mildred K. Havens. Reprint No. 2273 from the Public Health Reports, 13 pages; 5 cents.

Lead and Arsenic Ingestion and Excretion in Man. 1941. 10-page reprint No. 2290 from Public Health Reports; 5 cents.

Executive Agreements—Power. Temporary diversion for power purposes of additional waters of the Niagara River above the falls, arrangement between the United States and Canada, effected by exchange of notes signed at Washington, May 20, 1941, approved by the President of the United States June 13, 1941. 3-pages, State Department, Executive Agreement Series 209; 5 cents.

Flotation of Weathered Alabama Graphitic Schists for Crucible Flake, by J. Bruce Clemmer, Richard W. Smith, B. H. Clemmons and R. H. Stacy. Report of the results of experiments conducted by the Bureau of Mines at its southern experiment station, Tuscaloosa, Alabama, in cooperation with the University of Alabama, in connection with the domestic production of a "critical" type of flake graphite. Bureau of Mines Bulletin No. 49, obtainable only from

the Geological Survey of Alabama, University, Alabama; only charge is 3 cents for postage.

Technical Research by the Bureau of Mines in Oil and Gas Production, Refining and Utilization, by H. C. Miller and G. B. Shea. Bureau of Mines, Information Circular 7173; mimeographed.

Petroleum Engineering Study of the Anahuac Field, Chambers County, Texas, by Charles B. Carpenter and H. J. Schroeder. Bureau of Mines, Report of Investigations 3579; mimeographed.

Ferromanganese-Grade Concentrates from The Cuyuna Range, by S. M. Shelton and M. M. Fine. Bureau of Mines, Report of Investigations 3582; mimeographed.

Investigations of Methods and Equipment Used in Stream Gaging, Part 2, Intakes for Gage Wells. Geological Survey Water Supply Paper 868-B; 15 cents.

Control of Welding Hazards in Defense Industries. Division of Labor Standards, Department of Labor, Special Bulletin No. 5; 10 cents.

Tin-bearing pegmatites of the Tinton district, Lawrence County, S. Dak., a preliminary report, by W. C. Smith and L. R. Page, 1941. (Includes title pages, contents, lists of illustrations, and indexes for part 1, A-K, and part 2, L-T.). U. S. Geological Survey Bulletin 922-T; $1.00.

Commercial Standards. Diamond core drill fittings. 3d edition. 1941. Natl. Bureau of Standards, Commercial Standard 17; 10 cents.

Charts for Testing Lens Resolution. 8 pages of charts designed for testing the resolving power of photographic lenses. Bureau of Standards, Miscellaneous Publication 166; $1.25. Full instructions for using these charts are given in the Bureau of Standards Circular listed below.

Test of Lens Resolution for the Photographer. This circular provides the photographer with a set of charts by which the resolving power of a photographic lens may be numerically measured with respect to a definite scale of values. Gives a detailed description of procedure and technique to be followed in order that comparable values may be obtained by different observers. Bureau of Standards Circular 428; 40 cents.

Federal Specifications: New or revised specifications include: Glue, casein-type, water resistant, C-G-456. Asphalt, cutback (for) road work, SS-A-671a. Chrome-yellow and chrome-orange, dry, paste-in-japan, and paste-in-oil, TT-C-291a. Paint, cement-water, powder, white and tints (for interior and exterior use), TT-P-21. Vermiculite Insulation, block and pipe covering (molded), HH-I-578. Cans, safety (for gasoline, naphtha, etc.), RR-C-92. 5 cents each.

Geology and Oil and Coal Resources of the Region South of Cody, Park County, Wyo., by W. G. Pierce and D. A. Andrews, Department of the Interior, Geological Survey Bulletin 921-B; $1.00.

Latin America as a Source of Strategic and Other Essential Materials. Tariff Commission Report No. 144, second series; 50 cents.

Developments in the American Petroleum Industry, 1914-19, (Exploration, Drilling, Production and Transportation), by H. C. Fowler. Bureau of Mines Information Circular 7171; mimeographed.

RECENT BOOKS and PAMPHLETS

Oxygen-Boosting of Diesel Engines for Take Off. By *P. H. Schweitzer* and *E. R. Klinge.* Bulletin No. 54 of the Pennsylvania State College Engineering Experiment Station, State College, Pa. 27 pages. Price 50 cents. The studies outlined and described in this booklet indicate that the size of the engine in diesel-engined airplanes could be reduced 25 percent by feeding oxygen into the intake air during the take-off.

Industrial Health Practices. A report of a survey of 2,064 industrial establishments conducted under the direction of *Dr. Victor G. Heiser.* Gives much information regarding value, use, age and cost of health programs, also regarding

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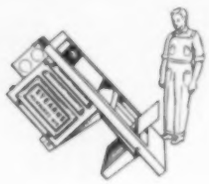

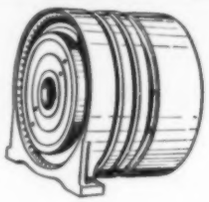

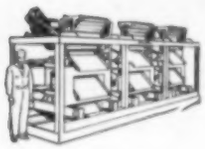

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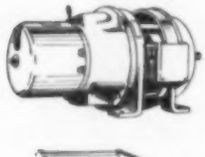

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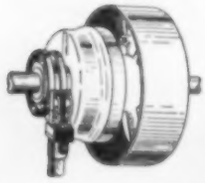

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industrial physical examination practices. Issued by the National Association of Manufacturers, New York, N. Y. 76 pages. Price 50 cents.

Code for Measurement of Water Using ISA Orifices With Free Discharge. Published by The Hydraulic Institute, New York, N. Y. 21 pages. Price $1. A guide for measurement of capacity in the field. Gives applications and construction specifications of the standard ISA orifice meter and also includes large flow rating charts for orifices on 4- to 12-in. pipe.

Symposium on Color. Published by the American Society for Testing Materials, Philadelphia, Pa. 79 pages. Price $1.25. Six papers, with discussions, presented at the Spring meeting of A.S.T.M. Titles are: Introduction to Color; Color Specifications of Transparent Materials; Hiding Power and Opacity; Color Standards for Opaque Materials; Spectrophotometry and Color Evaluation; Photoelectric Tristimulus Colorimetry.

Natural and Synthetic Rubbers. By *Harry L. Fisher.* Published by the American Society for Testing Materials, Philadelphia, Pa. 31 pages. Price 50 cents. The Edgar Marburg Lecture, presented at the Annual Meeting of A.S.T.M.

Effects of the Defense Program on Prices, Wages and Profits, by *Meyer Jacobstein* and *Harold G. Moulton.* Pamphlet No. 29 of The Brookings Institution, 43 pages. Obtainable from The Brookings Institution, 722 Jackson Place, Washington, D. C.; 25 cents.

Our World Trade, January-June, 1941. Value and Volume of Principal Exports and Imports between United States and Chief Foreign Markets. Obtainable without charge from the Chamber of Commerce of the United States, Washington, D. C.

Technical Association Papers. Series XXIV. Edited by *R. G. Macdonald* and *V. F. Waters.* Published by the Technical Association of the Pulp and Paper Industry. 752 pages. Price $6. Papers and addresses presented before the annual TAPPI meeting last February.

Thermodynamics of Boiler Feeding. By *I. J. Karassik.* Published by Hydraulic Institute, New York, N. Y. 39 pages. Price 50 cents. Prepared to enable the power-plant designer to understand thermodynamics of boiler feeding equipment and to decrease overall invested and operating cost per kwh. Describes feed cycles, discusses pumping power and mechanical problems with relation to feedwater temperature. Also included is a chapter on analysis of temperature rise in boiler feed pumps and discussion of minimum permissible capacities. Subjects of thermodynamic efficiency of boiler-feed pumps and disposal by by-pass and leak-offs are also covered.

Career in Engineering. By *Lowell O. Stewart.* Published by Iowa State College Press, Ames, Iowa. 87 pages. Price 75 cents. Vocational guidance for young men—and parents. Explains what engineering is, what the engineer does, who should study engineering, and the factors determining success.

Metallurgy. By *Robert S. Williams.* Published by Bellman Publishing Co., Boston, Mass. 12 pages. Price 50 cents. Number 33 of a series of vocational monographs. Gives duties, qualifications, education and training of a metallurgist as well as employment possibilities (including those for women) and compensation. Includes a list, with tuition costs, of schools offering metallurgical courses.

Standards on Petroleum Products and Lubricants. Published by the American Society for Testing Materials, Philadelphia, Pa. 390 pages. Price $2. New standards in this annual volume give specifications for aviation gasoline and tests for knock characteristics of aviation fuels, standardized method of determining the ignition quality of Diesel fuels, and procedures for testing the aniline point of petroleum products and for carbonizable substances in paraffin wax.

Standards on Electrical-Heating and Resistance Alloys. Published by the American Society for Testing Materials, Philadelphia, Pa. 100 pages. Price $1.25. Compilation giving test methods and specifications covering electrical-heating and electrical-resistance materials, thermostat metals, materials for lamps and radio tubes, and structural and electrical-resistor materials for furnaces.

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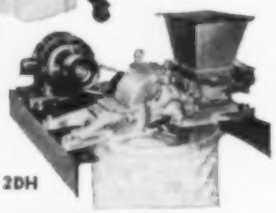

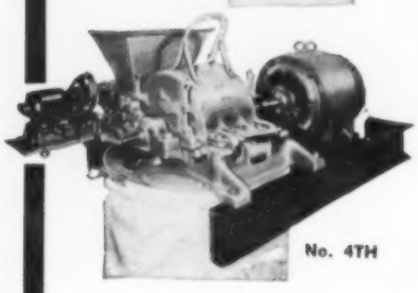

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Alloys. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee, Wis.—6-page folder which describes, illustrates and presents engineering data on this concern's bronze alloys for acid-resistant service. Includes tests to show resistance to corrosion with sulphuric acid solutions.

Alloys. The International Nickel Co., Inc., 67 Wall St., New York—Bulletin T20—16-page bulletin giving technical information on annealing nickel, Monel and Inconel, with extensive engineering information on annealing methods, atmospheres, fuels, grain-size control, temperature control and similar topics.

Ball Mills. H. K. Porter Co., Inc., Process Equipment Div., Pittsburgh, Pa.—Bulletin 201—4-page folder which illustrates and describes briefly this concern's lined, unlined, jacketed and unjacketed ball and pebble mills. Emphasis is placed on distinctive features and different types of mills.

Bearings. Miniature Precision Bearings, Keene, N. H.—Catalog 41—8-page folder illustrating and describing briefly this concern's radial, pivot, and special bearings in miniature precision sizes. Includes information on applications specifications, radial load ratings, and similar topics.

Bucket Loaders. The Jeffrey Mfg. Co., Columbus, Ohio—Catalog 759—12-page catalog on this concern's portable bucket loaders for coal, coke, sand, fertilizer, etc. Includes information on general specifications, applications, capacity and dimensions, and similar items.

Carbon Black. Godfrey L. Cabot, Inc., Boston, Mass.—4-page folder dealing with the use of carbon black in reclaimed bearing rubber tread stock. Includes engineering data on electrical conductivities of four grades of "Spheron" carbon blacks compounded in such stocks and also stress, strain and abrasion resistant properties thus imparted.

Chemicals. Commercial Solvents Corp., 17 E. 42nd St., New York—Wall chart, 21 in. × 31 in., which gives in tabular form extensive information on physical properties of this concern's solvents, diluents, and plasticizers. Includes data on solubility of important commercial coating materials in solvents, evaporation rates of diluents and plasticizers, solubility of commercial coating materials in plasticizers, and compatibility relationships in dried film. Reverse side contains useful data for the protective coating industry, such as principal factors influencing flow of lacquers and effect of moderate temperature changes on viscosity.

Chemicals. Mutual Chemical Co. of America, 270 Madison Ave., New York—48-page bound booklet on this concern's chromium chemicals, their uses and technical properties. Includes a map showing location of chrome ore mines and plants throughout the world. Give extensive information on seven chromium chemicals, including description of physical and chemical properties, principal uses, grades and packing, solubility charts and pH of solutions. Also conversion tables for degrees Baume to pounds per gallon, analytical methods and a complete list of this concern's products.

Chemicals. The Neville Co., Neville Island, Pittsburgh, Pa.—40-page 1941 catalog of the coal-tar solvents put out by this concern. Includes extensive information on various grades, specifications and uses of refined and semi-refined coke-oven light oil distillates and special coal-tar solvents including benzols, toluols and others. Also specific gravity and temperature conversion tables.

Colorimetric Analysis. Fisher Scientific Co., Pittsburgh, Pa.—8-page folder on this concern's new a.c. model "Electrophotometer" for colorimetric analysis. Includes photographs of the instrument and its operation, discussion of distinctive features, applications of colorimetric analysis, and list prices of the instrument, accessories and replacements.

Compressors. B. F. Sturtevant Co., Hyde Park, Boston, Mass.—Catalog 458—20-page catalog illustrating and describing briefly the centrifugal compressors put out by this concern. Includes engineering data on design, construction and application, methods of drive, lubrication and control.

Concretes. The Atlas Lumnite Cement Co., 135 E. 42nd St., New York—14-page bulletin which deals with refractory insulating concrete made with "Lumnite." Includes directions for preparation and extensive engineering data in chart and graph form on thermal characteristics. Also 16-page bulletin on corrosion-resistant concrete, with data on properties and resistance of "Lumnite" concrete to industrial wastes, stack conditions, gypsum mines, etc. Also information on requirements for making corrosion-resistant concrete, corrosion-resistant concrete floors, protective coatings, and industrial plant maintenance.

Control Instruments. The Bristol Co., Waterbury, Conn.—Bulletin 583—4-page folder with a flowsheet for sulphite pulp manufacture which shows installation of control instruments in the cycle.

Control Instruments. The Hays Corporation, Michigan City, Ind.—Monograph 8—4-page form on "adapting automatic combustion control to the characteristics of gas burners" which discusses control of gas flow and furnace draft, automatic combustion control systems and scheme of operation of metering type combustion control equipment as applied to a gas-fired boiler.

Conveyors. The Jeffrey Mfg. Co., Columbus, Ohio.—Catalog 758—16-page catalog on this concern's portable belt conveyors of both troughed and flat types for handling of all types of loose materials. Includes data on general specifications, applications, capacities and dimensions. Also Catalog 761—20-page bulletin on scraper conveyors of both wheel and crawler mounted types for handling coal, coke, etc. Includes photographs of different types, general specifications, applications and dimensions.

Cooling Water. D. W. Haering & Co., Inc., 205 W. Wacker Drive, Chicago, Ill.—46-page booklet of reprints on scale, corrosion and living organisms in cooling water systems. Subjects include experimental methods of studying cooling water problems, causes and prevention of corrosion of steel and copper alloys, and microbiological deposits. Many useful charts, tables and photographs are included.

Corrosive Liquids. National Lead Co., 111 Broadway, New York—36-page bound booklet dealing with this concern's lined products for the handling of corrosive liquids. Contains photographs, brief descriptive material, dimension tables, cross-sectional drawings, and list prices of acid valves of various types and sizes, plug cocks, lead and tin-lined pipes and fittings, centrifugal acid pumps and lead-lined and lead-covered equipment.

Diesel Engines. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.—80-page booklet which shows photographs and describes briefly installations of this concern's heavy duty diesels in both municipal and industrial plants. Captions list the equipment used and the typical annual earnings resultant.

Diesel Engines. Worthington Pump & Machinery Corp., Harrison, N. J.—Form S500B38A—8-page folder on this concern's four-cycle, direct-injection, totally inclosed diesel engines, with general descriptive material, photographs of various installations, cross-sectional drawings and data on principal dimensions.

Electrical Equipment. Kato Engineering Co., 530 N. Front St., Mankato, Minn.—4-page folder which illustrates and discusses briefly this concern's alternating current lighting and power equipment. Includes engineering data on generators, engines, dimensions, fuel consumption and starting.

Electrical Equipment. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.—Form B2306—77-page book describing plant distribution system for use in industrial plants and power stations of both radial and secondary network distribution type. Includes information on substations, switchgears, auxiliary equipment, typical applications, specifications, assembly drawings and rating tables. Also Bulletin B2287, 22-pages describing distribution transformers up to 500 kva. made of "Hipersil", recently developed silicon steel. Manufacture and assembly of transformers are described and illustrated and use of this steel to give better regulation, increase flux and reduced size and weight is discussed.

Electrolytic Metal Working. Burgess Battery Co., Handicraft Division, 500 W. Huron St., Chicago—12-page illustrated booklet entitled "The Electrolick Work-Shop, a New Handicraft" which gives general information on the "electrolytic" drilling, cutting, and turning of metals by a novel method and simple apparatus. Gives directions for handicraft experimentation, apparatus and supplies required, and results that can be obtained.

Electroplating. E. I. duPont de Nemours & Co., Inc., Wilmington, Del.—16-page bulletin on chemicals, processes and materials for electroplating. Contains detailed information, including a list of patents, on cadmium, zinc, tin, and other metals, alkali cyanides, metal cleaning and pickling and carbonate removal.

Equipment. Link-Belt Speeder Corp., 307 N. Michigan Ave., Chicago, Ill.—Folder 1914—4-page folder illustrating and describing this concern's crawler shovel-dragline-crane, with information on new design features, clearances and dimensions, lifting capacities, and specifications. Also data book 1874, 52-page catalog on this concern's positive, infinitely variable all-metal chain gear, including information on different types and capacities, actual installations, speeds, torque ratings, and similar subjects.

Equipment. Stearns Magnetic Mfg. Co., Milwaukee, Wis.—Bulletin 225A—20-page catalog on magnetic clutches and magnetic clutch and brake combination put out by this concern. Contains engineering data on applications, dimension drawings, specifications, and photographs of installations. Also Bulletin 50 on "DH" drum-type separators with details on design and uses.

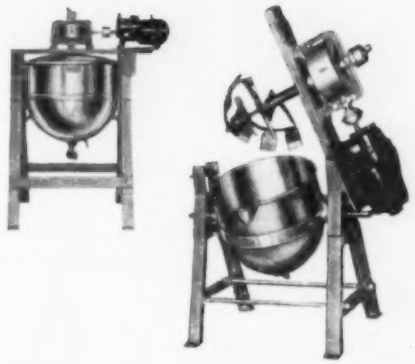
Floor Treatment. The Truscon Laboratories, Detroit, Mich.—Form 3B2—2-page sheet which deals with making cement floors non-dusting and oil-proof with this concern's "Granitex". Contains photographs and brief descriptive material.

Gas Engineering. The Selas Co., Erie Ave. and D St., Philadelphia, Pa.—14-page booklet entitled "Improved Processing" achieved through improved gas heat applications. Deals with applications of gas heating in the ceramic field and gives data on a new firing method, controllable radiant walls, cutting costs, kilns, etc.

Germicide. Monsanto Chemical Co., St. Louis, Mo.—Bulletin O-3—7-page folder on this concern's "Santophen 7", a germicide and industrial preservative. Contains detailed information on properties of ideal germicides, specifications for this product, physical and chemical properties, corrosiveness, toxicity to micro-organisms and to higher animals, applications as a disinfectant, enhancing agent, industrial preservative, and fungi-

Investigate LEE STAINLESS STEEL EQUIPMENT

BOOTHS 547&548 AT THE CHEMICAL SHOW



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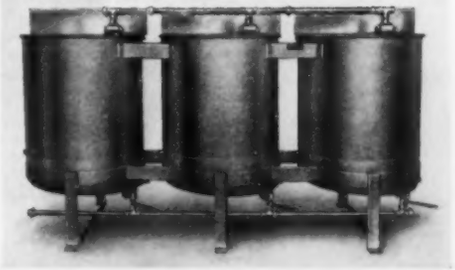

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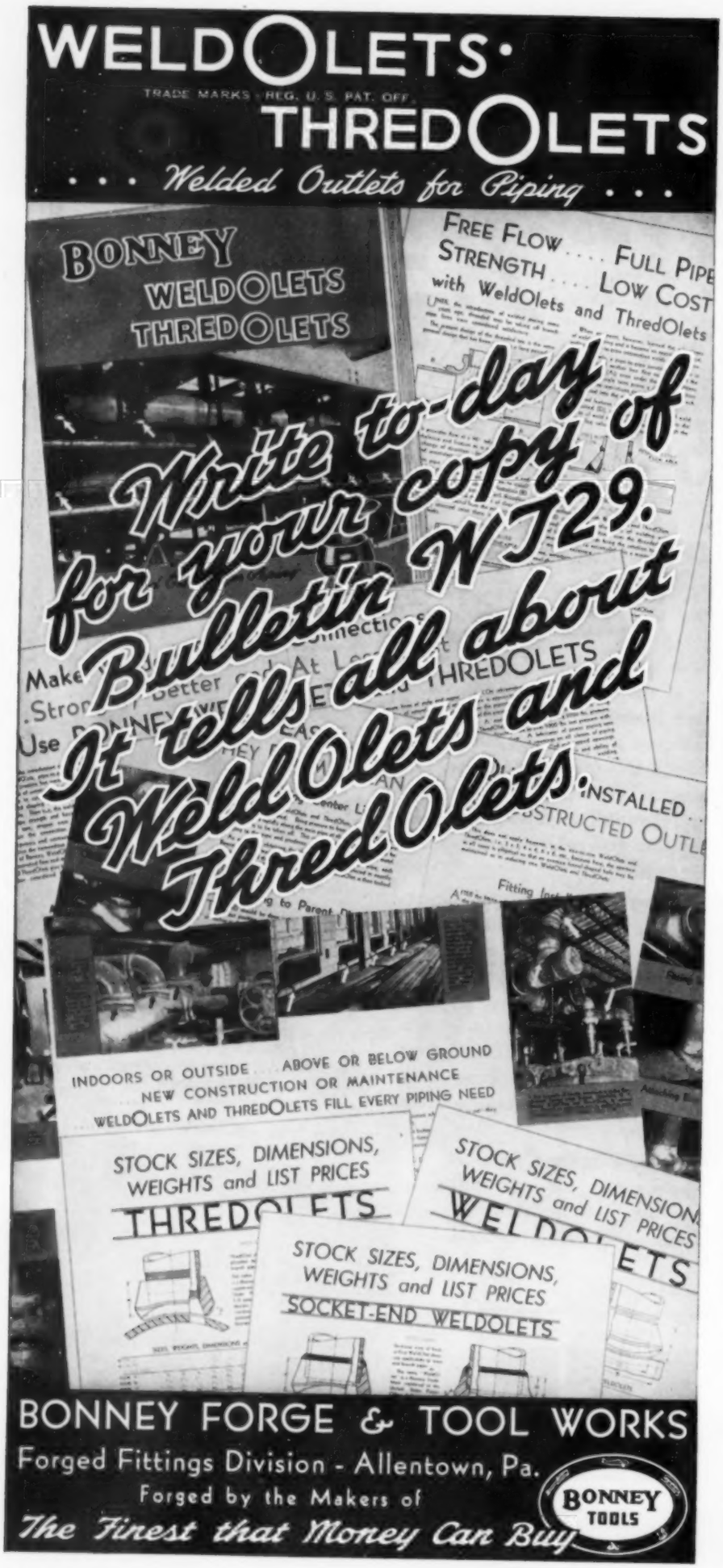
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cide, suggestions for handling, and packaging and shipping data.

Glass Tubing. Fish-Schurman Corp., 250 E. 43rd St., New York—Form 287K—one-page sheet on this concern's precision-bore glass tubes of various sizes, shapes and precision. Includes information on diameter tolerances and uses for scientific instruments.

Heaters. L. J. Wing Mfg. Co., 154 W. 14th St., New York—Bulletin HR1—16-page folder on this concern's revolving unit heaters for industrial plants. Contains information of value to architects, engineers, contractors, and business executives interested in the heating field.

Hydraulic Machinery. Watson-Stillman Co., Roselle, N. J.—Bulletin 110A—44-page bulletin on the self-contained, high-speed hydraulic machinery and equipment put out by this concern. Includes photographs of hydraulic presses, pumps, jacks and high pressure valves with descriptive information and also selective engineering tables on capacities of hydraulic rams, conversion tables, strength of materials, etc.

Instrument Charts. C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.—Catalog 1230—32-pages on charts put out by this concern for indicating, recording and controlling instruments. Includes complete specifications and descriptions of each of the different types.

Machinery. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Form B6177—12-page folder dealing with this concern's machinery for the processing industries. Includes photographs, descriptive material, and engineering data on machinery of various types for crushing, grinding and milling, mechanical separation, washing, disintegrating and material handling, and pyro-processing.

Metals. The Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.—No. 1 of this concern's new house organ entitled "Ajax Metelectric Progress", which will deal with non-ferrous ingot metals and alloys, low-frequency induction melting, high-frequency melting and heating and electric heat-treating furnaces as well as other products put out by this concern and its affiliates.

Metal Cleaner. Oakite Products, Inc., 22 Thames St., New York, N. Y.—Form 4305R2—20-page booklet on this concern's "Compound 32" for removal of hard water scales, rust and similar deposits from equipment, parts and other metallic surfaces. Discusses in detail various applications of the material, illustrated with photographs, and gives directions for use with compressors, condensers, heat exchange equipment, refrigerator equipment, paper mill pumps and suction rolls.

Photoelectric Instruments. Photovolt Corp., 95 Madison Ave., New York—14-page folder on this concern's "Lumetron" photoelectric fluorescence meter, with detailed technical information on construction features, sensitivity, operation, applications, and accessories. Also 10-page folder on the concern's photoelectric colorimeter, with technical information on construction details, accessories, reflection measurements, care of the instrument and operation.

Plastics. Monsanto Chemical Co., Plastics Div., Springfield, Mass.—20-page booklet on this concern's polystyrene molding compound trade-marked "Lustron". Contains descriptive material on manufacture, methods of molding, uses, and engineering data on tensile strength, electrical and other properties of the plastic. Profusely illustrated in both color and black-and-white.

Pumps. Kimball-Krogh Pump Co., 301 W. Ave. 26, Los Angeles, Calif.—Bulletin 120A—8-page folder describing this concern's horizontal centrifugal pumps with double-seal protection and flexibility of a rotatable discharge. Includes photographs of types, brief descriptive material, and engineering data on speed, head and capacity.

Pumps. Milton Roy Pumps, 1310 E. Mermaid Ave., Philadelphia, Pa.—Catalog 941—16-page catalog illustrating and describing briefly this concern's chemical pumps and proportioners. Includes in-

formation on uses in various industries, features of design, materials of construction, maximum pressure in pounds per square inch, and similar items.

Sheaves. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B6047—12-page folder on this concern's "Texsteel" and "Texdrive" steel and cast iron sheaves for drives from fractional to 25 hp. Lists available sizes, various dimensions, cross-sectional drawings and list prices.

Sleeve Bearings. Federal-Mogul Corp., Shoemaker and Lillibridge Sts., Detroit, Mich.—"Handbook of Sleeve Bearings" which discusses in detail the effect of design, alloys and manufacturing methods upon sleeve bearing efficiency, fields of application for each basic type, selection methods, and sizes and types of bearings and bushings for which major manufacturing tools are now available. Contains extensive engineering data in table, drawing, and chart form, and probably presents the most complete information available on the subject in any single publication. This bound book is available only to persons who are directly concerned with sleeve bearing installations.

Solders. Johnson Matthey & Co., Ltd., 606 Cathcart St., Montreal, Canada.—Three-page folder which gives information on this concern's hard silver and soft silver solders, including engineering data on melting range, hardness, yield point, recommended uses, and similar subjects.

Steel. Globe Steel Tubes Co., Milwaukee, Wis.—80-page bound booklet entitled "Outline of the Metallurgy of Iron and Steel," which gives the important steps in the converting of iron ore into finished steel products, manufacture of seamless tubing, corrosion, effect of alloying elements, and specifications.

Synthetic Rubber. The B. F. Goodrich Co., Akron, Ohio—Section 8000—8-page notebook folder dealing with the properties of "Ameripol D", this concern's synthetic rubber. Includes useful information on properties, such as tensile strength, color, abrasion-resistance, resistance to oils and solvents, adhesion to metals, etc. One table gives detailed properties of this synthetic rubber as compared to natural rubber, another the properties of typical vulcanized compounds, still another the percent volume increase after 48 hours immersion in various chemicals. Another table serves as a rough guide to determine where the use of Ameripol is practical.

Transformers. Sola Electric Co., 2525 Clybourn Ave., Chicago, Ill.—Bulletin CV74—21-page booklet on constant voltage transformers put out by this concern. Includes photographs, descriptive material, engineering data in chart and graph form, and specifications of various units.

Valves. Merco-Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh, Pa.—104-page, plastic-bound catalog on this concern's 98 types of steel valves and 121 types of semi-steel valves. Contains illustrations of each type, specifications, range of sizes, dimensions, working and test pressures, methods of operation, cross-sectional views, accessories, lubricants, and engineering data on similar items.

Waterproofing. The American Colloid Co., 363 W. Superior St., Chicago, Ill.—Data Form 229—14-page folder entitled "Effective Water Stoppage" which deals with the use of this concern's "Volclay" bentonite-base material for reducing seepage through soil and sand, to stop leaks in concrete structures, building foundations, mines, reservoirs, cracks and joints, etc. Describes nature of the product, how it works, typical industrial problems and how they have been solved by the use of this material, directions for use, prices and specifications.

Water Treating. General Chemical Co., 40 Rector St., New York—16-page reprint entitled "Water and Sewage Chemistry and Chemicals" prepared by a number of contributors. Discusses elementary chemistry of water and sewage treatment, units of measurement, preparation of standard solutions, hardness and alkalinity, calculations and methods used in water softening. Illustrated.

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by cutting spoilage of product in process

Bethlehem THERMOCOIL vessels insure uniformity of batch temperatures

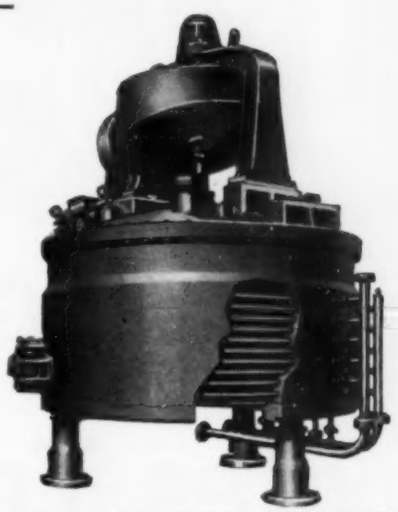
Eliminate Hot Spots

Insure Close Temperature Control

Check possible new economies in your distilling, evaporating, drying processes with a THERMOCOIL engineer.

See how THERMOCOIL vessels cut product spoilage by eliminating hot spots in the batch—how they effect *maximum heat transfer*—how they afford close control of process temperatures.

One chemical manufacturer, by replacing ordinary jacketed stills with THERMOCOIL units, for example, increased output of a heat-sensitive product 50 percent, due to a stepped-up processing time-cycle and to the elimination of spoiled batches.



Note how steel coils are cast integral with iron vessel walls to put more BTU's to work.

What THERMOCOIL is

THERMOCOIL's chief characteristic is a series of *cast-in* seamless steel coils integral with the vessel walls. Correct coil lengths (determined by field tests), exact distribution of live steam (or diphenyl) inlets, perfect bonding of coils and vessel walls give maximum heat transfer and uniform surface temperatures.

Why It Cuts Spoilage of Product

THERMOCOIL's coil-in-wall construction makes the whole area of the smooth inside vessel walls (and not the narrow, concentrated surfaces of individual coils) the uniform dispenser of closely controllable processing heat.

5 Other Advantages You Get with THERMOCOIL

1. *FLEXIBILITY.* THERMOCOIL permits *zone control* of heating as well as *uniformity*, or alternate heating and cooling.
2. *Less time out for cleaning.* THERMOCOIL's smooth inner surfaces (no visible inside coils) make cleaning fast and easy.
3. *ADAPTABILITY.* Vessel shapes beyond the possibilities of usual jacketed equipment without resort to special construction.
4. *Wide temperature range.* Up to 650° F. with 1,000,000 B.T.U. input, by using diphenyl or its compounds beyond the range of available steam pressures.
5. *No fire hazard.* Heat source isolated. Temperatures within normal range of direct-firing without direct-firing hazards.

Send for THERMOCOIL Catalog CM-11

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VERY LITTLE CHANGE SHOWN IN CURRENT RATE OF INDUSTRIAL CONSUMPTION OF CHEMICALS

Chem & Met ECONOMICS and MARKETS

A REVIEW of activities in the principal chemical-consuming industries indicates that manufacturing operations are going along in a relatively steady way with little variation in the monthly average. Current production schedules appear to be but little influenced by seasonal conditions and in most cases the question of obtaining raw materials is the most important factor in the rate of production. The preliminary figure for the index of industrial chemical consumption for October is 166 which is up less than seasonally over the revised figure of 164.14 for September. Last year the corresponding indexes were 154.58 and 140.84.

***Chem. & Met.* Index for Industrial Consumption of Chemicals**

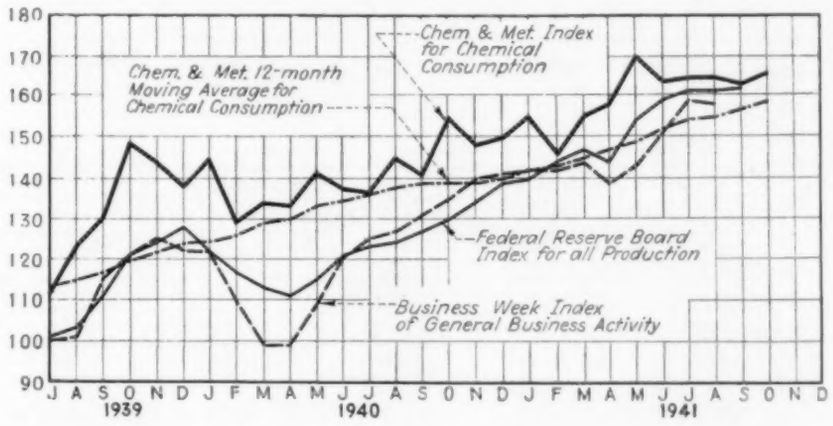
	August revised	Sept.
Fertilizers	29.95	29.65
Pulp and paper	22.30	22.80
Petroleum refining	15.97	15.64
Glass	15.40	14.85
Paint and varnish	15.79	16.45
Iron and steel	13.05	12.95
Rayon	13.33	13.10
Textiles	11.08	10.99
Coal products	9.31	9.28
Leather	5.04	5.00
Explosives	6.03	6.00
Rubber	3.58	3.66
Plastics	3.75	3.77
	164.58	164.14

Overall consumption of chemicals, however, is increasing. Much higher outputs of smokeless powder are now reported and this is also true for different high explosives. First shipments of toluol were made from the Bayway Ordnance Works on Oct. 22. In short, operations at plants manufacturing purely defense materials have been steadily gaining and have been calling for larger and larger amounts of chemicals. Making allowance for these activities, it is apparent that total production and consumption of chemicals is of record proportions.

That the trend for production will continue upwards is likewise evident from reports of further expansions which are to follow. For instance, the government program calls for plants to produce ammonia. While some time will elapse before all are in operation, the outlook is that methanol output will be increased when these ammonia plants start to function and that part of methanol equipment now given over to ammonia will be released. Incidentally present production of methanol is the largest in the history of the industry. Another indication of increased supplies of chemicals is found in the announcement that the Ethyl Gasoline Corp. will build a unit for the manufacture of hydrochloric acid and salt cake. As this hydrochloric acid will be used to replace chlorine in making tetraethyl lead, there will be an automatic release of a large quantity of chlorine and the salt cake will help to cut down the shortage in that material. While many plans for chemical expansion have been checked by inability to secure equipment, there is enough of added capacity to guarantee increasing outputs when added to totals turned out by government-owned establishments. This does not take into consideration the tendency of the government to make upward revisions in its needs for various chemicals, for instance, it is now reported that plans are being prepared for approximately doubling present schedules for production of toluol, this production to come from petroleum refineries.

So far as general lines of industry are concerned, particular conditions apply. Oil refining last month was the highest on record and as refining capacity will be extended to produce high octane gasoline, present records will not stand for long. Textile mills are getting very little silk but other fibers are readily available and outputs should continue on a large scale. Glass plants have established new production records this year but plate glass is due for a decline and container outputs may be reduced over the rest of the year. Paint mills have been affected by shortage of many materials but demand for the finished products promises to fall off in the immediate future. Plastics give a spotted picture with some branches at an all-time high and other plants partially closed. Control of rubber deliveries has cut down consumption but the use of reclaimed has made up in part for the lack of natural.

Seven more petroleum companies have been granted high priority ratings by OPM for construction of plants for production of 100 octane gasoline or of base stock and blending agents for this fuel as part of the drive to triple the current 40,000-barrel daily capacity.


Chem. & Met. Index for Chemical Consumption
Chem. & Met. 12-month Moving Average for Chemical Consumption
Federal Reserve Board Index for all Production
Business Week Index of General Business Activity
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J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
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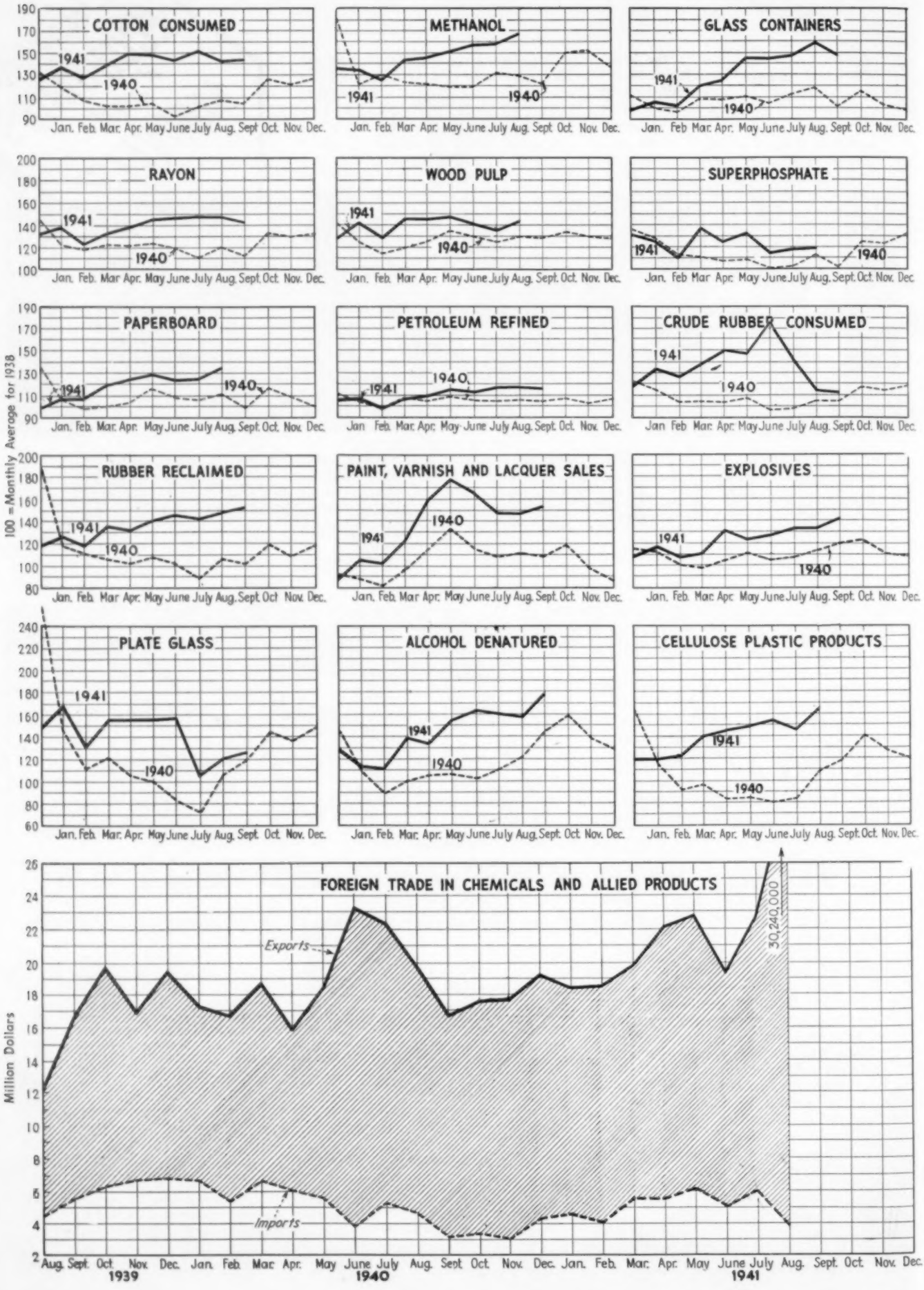
1940
1941

PRODUCTION AND CONSUMPTION DATA FOR CHEMICAL-CONSUMING INDUSTRIES

	September 1941	September 1940	January-September 1941	January-September 1940	Per cent of gain for 1941
Production					
Alcohol, ethyl, 1,000 pr. gal	35,757	21,550	262,847	192,715	36.3
Alcohol denatured, 1,000 wi. gal	16,908	13,694	124,327	93,766	32.6
Automobiles, no	234,255	269,108	3,821,840	3,005,212	27.2
Glass containers, 1,000 gr	6,286	4,288	51,117	40,845	25.1
Plate glass, 1,000 sq. ft	14,906	14,091	150,047	113,751	31.9
Window glass, 1,000 boxes	1,123	1,002	12,033	9,607	25.2
Cellulose acetate plastics, 1,000 lb	585	826	4,529	6,103	25.8*
Nitrocellulose plastics Sheets, rods and tubes, 1,000 lb	1,479	1,093	12,010	8,650	38.8
Pyroxylin spread, 1,000 lb	6,874	5,128	61,484	42,567	44.4
Rubber reclaimed, tons	24,678	16,379	201,918	152,796	32.1
Consumption					
Cotton, bales	875,682	638,235	7,883,998	5,766,369	36.7
Silk, bales	4,685	28,828	187,875	213,503	12.0*
Wool, 1,000 lb	52,976	36,550	465,238	271,068	71.6
Explosives, 1,000 lb	43,676	37,180	341,082	301,026	13.3
Paint and varnish, sales, $1,000	50,363	35,327	421,184	313,136	34.5
Rubber, crude, tons	53,655	52,469	602,851	471,431	27.9
Rubber reclaimed, tons	24,032	14,835	188,479	139,728	34.9

* Per cent of decline.

Production and Consumption Trends



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FACTS and FIGURES

of

AMERICAN CHEMICAL INDUSTRY

★ Reprinted from *Chem. & Met.'s* February 1941 issue, wherein the editors presented a 40-page public accounting of the economic and technical status of the nation's most important industry. It is addressed to everybody because we are all stockholders, customers and/or employees in this billion dollar business that in 1940 topped all production records.

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Chemical & Metallurgical Engineering

330 West 42 Street New York, N. Y.

DISTRIBUTION AND PRICES FOR CHEMICALS COME UNDER CLOSER GOVERNMENT CONTROL

PRIORITIES, price ceilings, and export restrictions are constantly becoming more important as factors in the market for chemicals. Under priority orders, delivery of a large part of chemical output is being dictated according to direct defense needs and to relative importance of industries which less directly fit into the general program. In addition to control over domestic deliveries, limitations are becoming more numerous with respect to foreign trade. A new order, effective Nov. 20, directs that shipments of specified chemicals under general licenses shall be restricted to Canada, Great Britain, Northern Ireland, Newfoundland, and the Philippines.

Chemicals specified in this order include: allyl alcohol and polymers and copolymers; allyl chloride and polymers and copolymers, cellosolve acetate, not plasticized; cellosolve acetate sheets, rods and tubes; cellulose acetate butyrate; cobalt naphthenate; dipentene; ethyl alcohol; ethylene dichloride; ethylene chloride; ethylene glycol monoethyl ether; ethyl ether; ethyl lactate; ester gum; ferric ammonium oxalate; gaseous refrigerants other than ammonia; iron blues; isopropyl alcohol; lead naphthenate; magnesium silicate; nicotine sulphate; paraformaldehyde; phosphorus oxychloride; propylene; glycol; sodium metasilicate; soluble sodium trisilicate; sulphated oils and fatty acids; sulphonated oils and fatty acids; tar-acid resins; toluidine red; trichlorethylene; vinyl resins; animal glue; gum and wood spirits of turpentine.

Most recent additions to commodities for which price ceilings have been established are acetone, normal butyl alcohol, and glycerine. The acetone schedule fixes a top price of 7¢ a lb. delivered in tank cars in eastern territory, which is defined as the states of New Mexico, Colorado, Wyoming, Montana and all states east of those points. For butanol, the price is established at 10¾¢ a lb. for tank car lots delivered in eastern territory. In each case a premium is allowed for deliveries in western territory, the premium being ¼¢ a lb. for tank car lots. In commenting on acetone it was stated that production in the current year is estimated at about 250,000,000 lb., an all-time record and a gain of almost 50,000,000 lb. over last year. Production of butyl alcohol for this year was estimated at 155,000,000 lb.

The price schedule for glycerine establishes base maximum figures of 11¼¢ a lb. for crude and 18¢ a lb. for refined. Production of glycerine this year will reach 200,000,000 lb. according to the estimate and about 50 percent of this will be used in the production of dynamite, and other explosives, synthetic resins, transparent cellulose wrapping material, and in processing tobacco. Many additional millions of pounds will be used in the manufacture of drugs, cosmetics, and printers inks. The textile, chemical, and paper industries will use about 5,000,000 lb. each, while more than 15,000,000 lb. will be consumed by the food industry.

In this schedule, refined glycerine is divided into five grades: chemically pure (98 percent glycerol), chemically pure (USP 95 percent glycerol), dynamite, high gravity, and yellow distilled. Maximum prices, in tank cars, are 18¼¢ a lb. for the 98 percent and 18¢ a lb. for the four other grades. Crude is divided into four grades; soap lye, (basis 80 percent glycerol), saponification (basis 88 percent glycerol), saponification (basis 88 percent) to refiners, and crude of other glycerol percentages. The price for soap lye in tank cars or drums, is 11¼¢ a lb. delivered; saponification for individual uses, 12¾¢ a lb. tank cars at point of manufacture, with 1¢ a lb. premium for car lots in drums; saponification grade for refiners is 12¾¢ delivered whether in tank cars or drums; the ceiling for crude will be determined at the rate of 11¼¢ a lb. delivered for glycerine of 80 percent glycerol content.

In connection with the price schedule previously announced for ethyl alcohol, an exception has been made in the case of the Pennsylvania Alcohol Corp. which is permitted to charge 5¢ a gal. more than the established maximum. This exception was made because investigation showed this producer had costs above the industry average.

So far, vegetable oils and animal fats have not come under any definite price control although their price movements have been far more drastic than has been the case in chemicals. The sharp upward trend which has been in evidence in recent months, however, was checked in recent weeks and a lower average was recorded for the current month with crude cottonseed oil and linseed oil figuring prominently on the down side. Outside of the limited

CHEM. & MET.

Weighted Index of

CHEMICAL PRICES

Base = 100 for 1937

This month	**103.89**
Last month	104.05
November, 1940	99.53
November, 1939	97.73

Extension of prices for delivery over next year was reported for several chemicals. The list for which price ceilings have been announced is growing. Where price controls are lacking, prices are firm because of limited offerings.

amount of chemicals which have brought high prices in the resale market, sales schedules have been remarkably steady and many of the more important tonnage chemicals have been offered for 1942 delivery at unchanged price levels.

There has been no change in the fundamental position of chemicals from the supply standpoint, rather shortage appears to become more acute and to extend over a wider range of commodities. This results not only because of the active call for all chemicals but also to the wider control over distribution which makes it more difficult for some consuming industries to obtain supplies. Transportation problems also still continue as a factor and this is especially true for such important materials as phosphate rock, potash salts, and sulphur where rail deliveries have largely supplanted the movement by water routes.

In the paint industry, shortage of raw materials has influenced producers to coordinated action which is somewhat in the nature of a pool whereby one manufacturer may exchange a material for which he has not immediate use, for another material which he urgently needs.

Foreign trade in chemicals and related products has continued along record lines but recent restrictions may cause some decline in our export business. However, the greatest of outward shipments have been destined for Great Britain and Canada. A report from Canada says that imports into that country for the first eight months of this year were valued at $41,900,000 coming chiefly from the United States as we supplied $34,700,000 of that total. In the same period Canada shipped out chemicals valued at $32,900,000 of which $9,800,000 went to the United States.

On Nov. 4, a general preference order placed cobalt under mandatory control. This includes domestic and imported ore and concentrates, metal, and cobalt chemicals. Deliveries of cobalt chemical compounds for nonmetallic uses are limited to 90 percent of the average monthly weight delivered for the first six months of 1941. A similar restriction is placed on manufacture of those chemicals which are not converted into cobalt metal.

CHEM. & MET.

Weighted Index of Prices for

OILS & FATS

Base=100 for 1937

This month	130.26
Last month	135.22
November, 1940	68.79
November, 1939	80.76

The sharply rising trend to values was checked last month with lower prices quoted for such basic oils as cottonseed and linseed. Foreign oils are firm and reductions in animal fats were but temporary.

For Defense Production Use Tensilastic Rubber Rolls

Tensilastic Rubber Rolls are doing their part during the defense program. They have replaced other "hard to secure" equipment in a great many plants. Possibly they can help speed up *your* production during the present emergency. For years Tensilastics have been producing in the paper, textile, tanning, steel, tobacco and hat industries. Write us about your manufacturing problems. We'll gladly give you the benefit of our experience regarding the adaptability of rubber rolls.

During the past 50 years we have manufactured rubber rolls and mechanical rubber products for a number of industries. Today we are also supplying rubber products to meet the demands of defense production.

For Protection Use Rubber

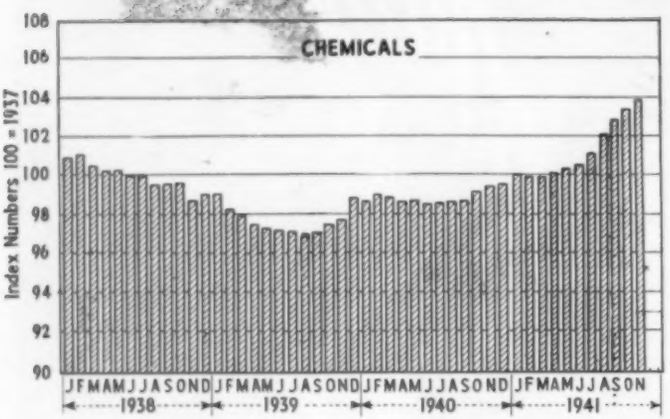
If you have equipment that requires protection against acids, fumes and other harmful elements, consider rubber. We rubber cover and rubber line tanks. We also rubber cover propellers, machine parts and a variety of other products. Write us regarding the advantage of rubber for protection.

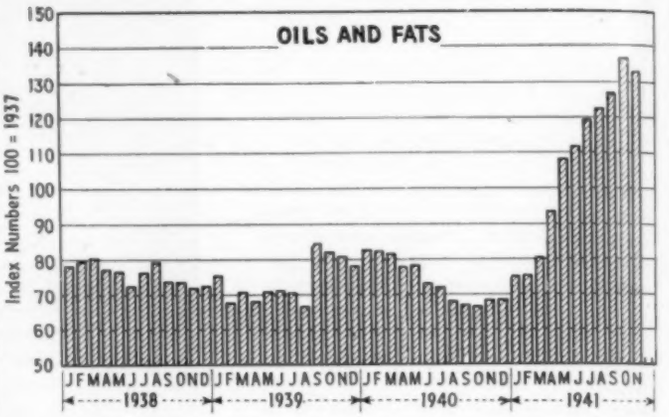
AMERICAN WRINGER CO., Inc.

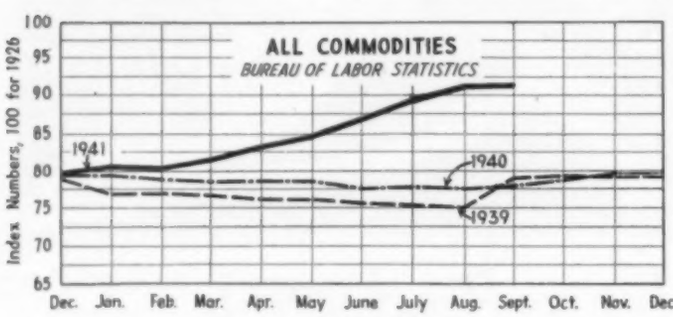
WOONSOCKET, R. I.

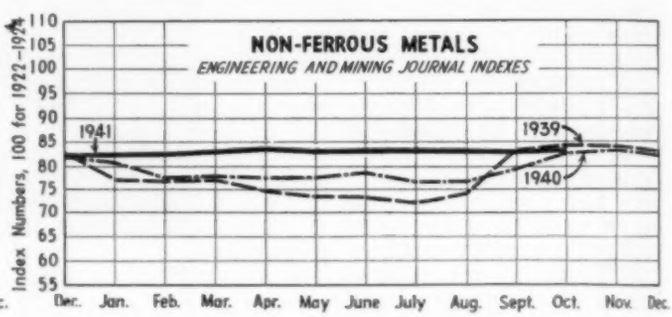
• TENSILASTIC •

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52 –$0.55	$0.52 –$0.55	$0.52 –$0.55
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.15 – .16	.15 – .16
Aniline, salts, bbl., lb.	.22 – .24	.22 – .24	.22 – .24
Benzaldehyde, U.S.P., dr., lb.	.85 – .95	.85 – .95	.85 – .95
Benzidine base, bbl., lb.	.70 – .75	.70 – .75	.70 – .75
Benzoic acid, U.S.P., kgs., lb.	.54 – .56	.54 – .56	.54 – .56
Benzyl chloride, tech., dr., lb.	.23 – .25	.23 – .25	.23 – .25
Benzol, 90%, tanks, works, gal.	.14 –	.14 –	.14 – .....
Beta-napthol, tech., drums, lb.	.23 – .24	.23 – .24	.23 – .24
Cresol, U.S.P., dr., lb.	.10½– .11	.10½– .10¾	.09½– .10
Cresylic acid, dr., wks., gal.	.81 – .83	.81 – .83	.58 – .60
Diethylaniline, dr., lb.	.40 – .45	.40 – .45	.40 – .45
Dinitrophenol, bbl., lb.	.23 – .25	.23 – .25	.23 – .25
Dinitrotoluol, bbl., lb.	.18 – .19	.18 – .19	.15½– .16
Dip oil, 15%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, dr. fob wks., lb.	.70 –	.70 –	.....
H-acid, bbl., lb.	.45 – .50	.45 – .55	.45 – .50
Naphthalene, flake, bbl., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Nitrobenzene, dr., lb.	.08 – .09	.08 – .09	.08 – .09
Para-nitraniline, bbl., lb.	.47 – .49	.47 – .49	.47 – .49
Phenol, U.S.P., drums, lb.	.13 –	.13 –	.13 – .....
Picric acid, bbl., lb.	.35 – .40	.35 – .40	.35 – .40
Pyridine, dr., gal.	1.70 – 1.80	1.70 – 1.80	1.70 – 1.80
Resorcinol, tech., kegs, lb.	.75 – .80	.75 – .80	.75 – .80
Salicylic acid, tech., bbl., lb.	.33 – .40	.33 – .40	.33 – .40
Solvent naptha, w.w., tanks, gal.	.27 –	.27 –	.27 – .....
Tolidine, bbl., lb.	.86 – .88	.86 – .88	.86 – .88
Toluol, drums, works, gal.	.32 –	.30 –	.30 – .....
Xylol, com, tanks, gal.	.26 –	.26 –	.26 – .....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech, bbl, lb.	.23 – .26	.26½– .30	.11½– .13
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335– .30	.0335– .30	.028– .30
Prussian blue, bbl., lb.	.36 – .37	.36 – .37	.36 – .37
Ultramarine blue, bbl., lb.	.11 – .26	.11 – .26	.10 – .26
Chrome green, bbl., lb.	.21½– .30	.21½– .30	.21 – .27
Carmine, red, tins, lb.	4.60 – 4.75	4.60 – 4.75	4.85 – 5.00
Para toner, lb.	.75 – .80	.75 – .80	.75 – .80
Vermilion, English, bbl., lb.	3.20 – 3.25	3.20 – 3.25	nom
Chrome yellow, C.P., bbl., lb.	.14½– .15½	.14½– .15½	.14½– .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 – .10	.08 – .10	.06 – .06½
Gum copal Congo, bags, lb.	.09 – .30	.09 – .30	.06 – .30
Manila, bags, lb.	.09 – .15	.09 – .14	.09 – .14
Damar, Batavia, cases, lb.	.10 – .22	.10 – .20	.08 – .24
Kauri, cases, lb.	.18 – .40	.18 – .60	.18½– .60
Kieselguhr (f.o.b. mines), ton.	7.00 –40.00	7.00 –40.00	7.00 –40.00
Magnesite, calc, ton	65.00 –	65.00 –	65.00 – .....
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	nom	nom	.03 – .04
Rosin, H., 100 lb.	3.13 –	3.10 –	2.51 – .....
Turpentine, gal.	.83 –	.83 –	.45 – .....
Shellac, orange, fine, bags, lb.	.39 –	.38 –	.26 – .....
Bleached, bonedry, bags, lb.	.37 –	.35 –	.24 – .....
T. N. Bags, lb.	.29 –	.28 –	.15 – .....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
200 mesh (f.o b. Ga.), ton.	6.00 – 8.00	6.00 – 8.00	7.50 –11.00

Industrial Notes

THE DREVER CO., Philadelphia, has appointed Gerald B. Duff as its representative in metropolitan New York and northeastern Pennsylvania. Mr. Duff will make his headquarters at 68 Clinton Ave., Newark.

HYDROCARBON CHEMICAL & RUBBER CO., Akron, has changed its corporate name to Hycar Chemical Co.

GENERAL ELECTRIC CO., Schenectady, has appointed Warren C. Hutchins manager of sales of the special products section of the industrial department to succeed Dr. H. A. Jones now in charge of sales of nonradio electronic tubes.

LINK-BELT CO., Chicago, has appointed William Alex Craig purchasing agent of the company's plant at Philadelphia to succeed James C. Lenahan who died on Sept. 7.

THE PORCELAIN ENAMEL AND MFG. CO., Baltimore, announces the appointment of George L. Hubbell as sales engineer for the midwestern territory.

YORK ICE MACHINERY CORP., York, Pa., has organized a new department known as the accessory equipment and maintenance department and has placed J. L. Rosenmiller in charge. Fred C. Wood has been appointed manager of the air conditioning department.

CHAIN BELT CO., Milwaukee, has appointed A. W. Thomas sales manager of the construction machinery division, D. A. Kalton as assistant sales manager, and A. J. Frank as assistant to the manager of the division. The company recently appointed G. K. Viall head of the newly organized division of research and development.

INTERNATIONAL AGRICULTURAL CORP., Chicago, has voted to change its name and effective Dec. 1 will become the International Minerals & Chemicals Corp.

S. L. ABBOTT CO., San Francisco, will open a plant this month at Livermore, Calif., for the manufacture of agricultural products.

BRIDGEPORT BRASS CO., Bridgeport, Conn., has appointed Harry J. Lehman to succeed the late H. B. Whitaker as district manager of the office at 70 Clifford St., Providence.

MONSANTO CHEMICAL CO., St. Louis, has advanced J. Fred Reeves to the position of assistant plant manager at Anniston, Ala.

YOUNG RADIATOR CO., Racine, Wis., announces that Robert Grant has joined the company in a production and managerial capacity.

BLAW-KNOX CO., Pittsburgh, has appointed Edwin A. Wert vice-president in charge of engineering and sales of its power piping division.

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.08½–$0.09	$0.09½–$0.10	$0.07½–$0.08
Acid, acetic, 28%, bbl., cwt.	3.18 – 3.43	3.18 – 3.43	2.23 – 2.48
Glacial 99.5%, drums	8.68 –10.00	8.68 –10.00	8.43 – 8.68
U. S. P. X1, 99.5%, dr.	10.50 –11.00	10.50 –11.00	10.25 –10.50
Boric, bbl., ton	106.00–111.00	106.00–111.00	106.00–111.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys., lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb.	1.05 – 1.15	1.05 – 1.15	.90 – 1.00
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Muriatic, 18°, tanks, cwt.	1.05 –	1.05 –	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –	18.50 –20.00
Oxalic, crystals, bbl., lb.	.11½– .13	.11½– .13	.10½– .12
Phosphoric, tech., c'bys., lb.	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –	13.00 –	13.00 –
Sulphuric, 66°, tanks, ton	16.50 –	16.50 –	16.50 –
Tannic, tech., bbl., lb	.66 – .68	.66 – .68	.54 – .56
Tartaric, powd., bbl., lb.	.70 –	.46 –	.43½–
Tungstic, bbl., lb.	nom.	nom.	nom.
Alcohol, amyl,	–	–	–
From Pentane, tanks, lb.	.131–	.131–	.101–
Alcohol, Butyl, tanks, lb	.10 –	.11 –	.09 –
Alcohol, Ethyl, 190 p'f., bbl., gal.	7.92½–	7.92½–	6.04 –
Denatured, 190 proof	–	–	–
No. 1 special, dr., gal. wks.	.33 –	.33 –	.30½–
Alum, ammonia, lump, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Potash, lump, bbl., lb.	.04 – .04½	.04 – .04½	.03½– 04
Aluminum sulphate, com. bags, cwt.	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt.	1.85 – 2.10	1.85 – 2.10	1.60 – 1.70
Aqua ammonia, 26°, drums, lb.	.02½– .03	.02½– .03	.02½– .03
tanks, lb.	.02 – .02¾	.02 – .02¾	.02 – .02¾
Ammonia, anhydrous, cyl., lb.	.16 –	.16 –	.16 –
tanks, lb.	.04½–	.04½–	.04½–
Ammonium carbonate, powd. tech., casks, lb	.09 – .12	.09 – .12	.09 – .12
Sulphate, wks., cwt.	1.45 –	1.45 –	1.40 –
Amylacetate tech., from pentane, tanks, lb	.135–	.135–	.115–
Antimony Oxide, bbl., lb	.13–	.13 –	.13 –
Arsenic, white, powd., bbl., lb.	.04 – .04½	.04 – .04½	.03 – .03½
Red, powd., kegs, lb	nom.	nom.	.17 – .18
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	52.50 –57.50
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb.	.10½– .11	.10½– .11	.08½– .10
Blanc fixe, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	43.00 –	43.00 –	43.00 –51.00
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –	3.00 –	1.90 –
Arsenate, dr., lb.	.07½– .07¾	.07½– .07¾	.06½– .06¾
Carbide drums, lb	.04½– .05	.04½– .05	.04½– .05
Chloride, fused, dr., del., ton.	19.00 –24.50	19.00 –24.50	19.00 –24.50
flake, dr., del., ton.	20.50 –25.00	20.50 –25.00	20.50 –25.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05½–	.05½–	.05 –
Tetrachloride drums, gal.	.73 – .80	.73 – .80	.66½– .73
Chlorine, liquid, tanks, wks., lb.	2.00 –	2.00 –	1.75 –
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.c.b. wks, ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb.	.18 – .20	.18 – .20	.10 – .16
Sulphate, bbl., cwt.	5.15 – 5.40	5.00 – 5.25	4.75 – 5.00
Cream of tartar, bbl., lb.	.57 –	.57 –	.36½–
Diethylene glycol, dr., lb	.22 – .23	.22 – .23	.22 – .23
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb.	.08½–	.09½–	.07 –
Formaldehyde, 40%, bbl., lb.	.05½– .06	.05½– .06½	.05½– .06
Furfural, tanks, lb.	.09 –	.09 –	.09 –
Fusel oil, drums, lb.	.17½– .19	.17½– .19	.16 – .17
Glaubers salt, bags, cwt.	1.05 – 1.10	1.05 – 1.10	.95 – 1.00
Glycerine, c.p., drums, extra, lb.	.18½–	.19½–	.12½–
Lead:			
White, basic carbonate, dry casks, lb.	.07½–	.07½–	.07½–
White, basic sulphate, sck., lb.	.07½–	.07½–	.07 –
Red, dry, sck., lb.	.0835	.0835	.08½–
Lead acetate, white crys., bbl., lb.	.12 – .13	.12 – .13	.11 – .12
Lead arsenate, powd., bag, lb.	.09½– .11	.09½– .11	.09 – .11
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, pwd., csk., lb.	.0735	.0735	.07¼–
Lithopone, bags, lb.	.0385– .04	.0385– .04	.036– .04
Magnesium carb., tech., bags, lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Methanol, 95%, tanks, gal.	.60 –	.73 –	.29 –
97%, tanks, gal.	.60 –	.75 –	.30 –
Synthetic, tanks, gal.	.28 –	.28 –	.30 –
Nickel salt, double, bbl., lb.	.13½– .13¾	.13½– .13¾	.13 – .13¾
Orange mineral, csk., lb	.11½–	.11½–	.11½–
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb.	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb.	.09½– .10	.09½– .10	.08½– .09
Carbonate, 80–85%, calc. csk., lb	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Muriate, 60% bags, unit	.53½–	.53½–	.53½–
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.19½– .20	.19½– .20	.18½– .19
Prussiate, yellow, casks, lb.	.17 – .18	.17 – .18	.15 – .16
Sal ammoniac, white, casks, lb.	.0515– .06	.0515– .06	.05½– .06
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –	17.00 –	23.60 –
Soda ash, light, 58%, bags, contract, cwt.	1.05 –	1.05 –	1.05 –
Dense, bags, cwt.	1.10 –	1.10 –	1.10 –
Soda, caustic, 76%, solid, drums, cwt.	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb.	.04½– .06	.04½– .06	.04 – .05
Bicarbonate, bbl., cwt.	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.07½– .08	.07½– .08	.06½– .07
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	15.00 –16.00
Bisulphite, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Cyanide, cases, dom., lb.	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.08 – .09	.08 – .09	.07 – .08
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.50 – 2.65	2.50 – 2.65	2.35 – 2.40
Nitrate, bulk, cwt.	1.47 –	1.47 –	1.45 –
Nitrite, casks, lb	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb.	2.35 –	2.35 –	2.25 –
Prussiate, yel. drums, lb.	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.) wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb.	.03 – .03½	.03 – .03½	.02½– .03
Sulphite, crys., bbl., lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton.	16.00 –	16.00 –	16.00 –
Chloride, dr., lb.	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb.	.07 – .08	.07 – .08	.07 – .07½
Flour, bag, cwt.	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb.	.55 –	.55 –	.54 –
Crystals, bbl., lb.	.39½–	.39½–	.38½–
Zinc, chloride, gran., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb.	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb.	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb.	.09½–	.09½–	.09½–
Zinc oxide, lead free, bag, lb.	.06½–	.06½–	.06½–
5% lead sulphate, bags, lb.	.06½–	.06½–	.06½–
Sulphate, bbl., cwt.	3.40 – 3.50	3.15 – 3.25	2.75 – 3.00

The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to November 12

OILS AND FATS

	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb.	$0.12½–$0.13	$0.12½–$0.13	$0.10½ –$0.11
Chinawood oil, bbl., b.	.35 –	.34 –	.26 –
Coconut oil, Ceylon, tank, N. Y., lb.	.07½–	.07½–	.02½–
Corn oil crude, tanks (f.o.b. mill), lb.	.11½–	.12½–	.05½–
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.11½–	.12½–	.04½–
Linseed oil, raw car lots, bbl., lb.	.10 –	.113–	.082–
Palm, casks, lb.	.09 –	.08½–	.03½–
Peanut oil, crude, tanks (mill), lb.	.12 –	.13 –	.05½–
Rapeseed oil, refined, bbl., lb.	.15½–	.15½–	.12 –
Scya bean, tank, lb.	.10½–	.11 –	.04½–
Sulphur (olive foots), bbl., lb.	.17 –	.16 –	.10 –
Cod, Newfoundland, bbl., gal.	nom.	nom.	nom.
Menhaden, light pressed, bbl., lb	.112–	.112–	.067–
Crude, tanks (f.o.b. factory) gal.	.58 –	.60 –	.21 –
Grease, yellow, loose, lb.	.08½–	.08½–	.04½–
Oleo stearine, lb.	.09½–	.09½–	.06½–
Oleo oil, No. 1	.11½–	.11½–	.05½–
Red oil, distilled, dp.p. bbl., lb.	.12 –	.12 –	.06 –
Tallow extra, loose, lb.	.09 –	.09 –	.04½–

Chem & Met New CONSTRUCTION

	Current Projects — Proposed Work	Current Projects — Contracts	Cumulative 1941 — Proposed Work	Cumulative 1941 — Contracts
New England	$40,000	.....	$2,955,000	$4,508,000
Middle Atlantic	3,040,000	$15,538,000	30,640,000	51,790,000
South	6,750,000	.....	52,573,000	248,734,000
Middle West	33,615,000	65,183,000	54,420,000	155,140,000
West of Mississippi	9,800,000	472,000	67,855,000	258,040,000
Far West	15,300,000	2,350,000	28,562,000	55,123,000
Canada	730,000	350,000	3,002,000	650,000
Total	$69,275,000	$83,893,000	$240,007,000	$773,985,000

PROPOSED WORK

Ark., El Dorado—War Dept., Wash., D. C., plans to construct an anhydrous ammonia and ammonium nitrate plant here to be known as Ozark Ordnance Works.

Ark., Pine Bluff—War Dept., Wash., D. C., plans to construct a plant for the manufacture of magnesium and thermite incendiary bombs, including chemical warefare and storage depots, laboratories, etc., for Chemical Warfare Service. Project will cost several million dollars.

Calif., Richmond—Standard Oil Co. of California, 225 Bush St., San Francisco, contemplates the construction of a lubricating plant at the Richmond Refinery to produce high grade aviation lubricants. Estimated cost $5,000,000.

Conn., Norwalk—N. V. Maatschappij Voor, Chemische en Pharmaceutische Production, Hamilton St., Stamford, is having plans prepared by David Mansail, Archt., 24 Park Row, Stamford, for alterations and additions to its factory on Merwin St. Estimated cost will exceed $40,000.

Ga., Savannah—Union Bag & Paper Co., c/o C. A. O'Brien, Purch. Agt., Savannah, plans to construct an addition to its mill. Estimated cost $4,000,000.

Ill., Chicago—Amertorp Corp., c/o American Can Co., 230 Park Ave., New York, N. Y., is having plans prepared by R. Love, Archt., 104 South Michigan Ave., for the construction of a torpedo plant. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost including equipment $9,000,000.

Ind., Elwood—U. S. Plastic Insulation Corp., C. H. Bolte, Mgr., has acquired the plant formerly occupied by the Pittsburgh Plate Glass Co. at North St. and Pennsylvania R. R. tracks, and will remodel same for the manufacture of plastic insulation. Estimated cost including equipment may exceed $40,000.

Ind., Indianapolis—Consolidated Rubber Laboratories, Inc., 400 Division St., plans to rebuild and reequip its plant recently destroyed by fire. Estimated cost including equipment $75,000.

Ky., Louisville—Hycar Chemical Co., c/o B. F. Goodrich Rubber Co., 100 West Bway., and Phillips Petroleum Co., Preston and Barnett Sts., will soon receive bids for rubber factory for War Dept. Defense Plant Corp. will finance. Estimated cost $2,750,000.

Mich., Grand Rapids—Extruded Metals Defense Corp., Belding, plans to construct a plant for the manufacture of extruded aluminum alloys for the War Dept., Wash., D. C. Project will be financed by the Defense Plant Corp. Estimated cost of land and buildings $2,500,000; machinery and equipment $3,966,000.

Minn., Crosby—War Dept., Wash., D. C., plans to construct a manganese concentrating plant here. Estimated cost $5,000,000.

N. J., Cape May—Northwest Magnesite Corp., Farmers Bldg., Pittsburgh, Pa., plans to construct a magnesite factory here. Estimated cost $1,000,000.

N. Y., Brooklyn—H. Kohnstamm & Co., 87 Park Pl., New York, N. Y., is having plans prepared by Wm. Higginson & Son, Archts., 101 Park Ave., New York, N. Y., for a 50x60 ft. factory on Bay St. Estimated cost $40,000.

O., South Point—War Dept., Wash., D. C., plans to construct an ammonia plant here to be known as the Buckeye Ordnance Works. Atmospheric Nitrogen Corp., subsidiary of Allied Chemical & Dye Corp., 61 Bway., New York, N. Y., will operate plant which will be financed by Defense Plant Corp. Estimated cost $22,000,000.

Ore., Troutdale—Defense Plant Corp., Wash., D. C., plans to establish a 100,000,000 lb. aluminum reduction plant here to be built and operated by Aluminum Corp. of America, Pittsburgh, Pa. Estimated cost $10,000,000.

Pa., Brownsville—War Dept., Wash., D. C., plans to construct a plant for the manufacture of TNT from toluene here. Cost will run into several million dollars.

Tex., Borger—Phillips Petroleum Co., Bartlesville, Okla., plans to construct an octane gasoline refining unit. Estimated cost $200,000.

Tex., Corpus Christi—LaGloria Corp., Corpus Christi, plans to construct an Isobutane plant type refinery unit here. Estimated cost $175,000.

Tex., Deer Park—Shell Union Oil Corp., Shell Bldg., Houston, plans to construct a hydrocodimer plant type gasoline refining unit. Estimated cost $200,000.

Tex., Port Arthur—Gulf Refining Co., Port Arthur, plans to construct a gasoline refining unit. Estimated cost $225,000.

Wash., Spokane—Inland Empire Refineries, Inc., Spokane, plans to construct an addition to its refinery. Estimated cost $300,000.

B. C., Vancouver—Coast Paper Ltd., 311 Bank of Nova Scotia Bldg., plans to construct a paper manufacturing plant. Estimated cost $50,000.

B. C., Vancouver—Mantow Bros., Ltd., 105 Elizabeth St., Toronto, Ont., manufacturer of inks, etc., plans to construct a plant here. Estimated cost $40,000.

Ont., Georgetown—Provincial Paper Co., Ltd., Georgetown, plans to construct a plant here. T. Embleau, c/o Owner, Engr. Estimated cost $40,000.

Ont., Toronto—McCall-Frontenac Oil Co., Ltd., 117 Harbour St., will soon receive bids for a blending plant at its refinery on Cherry St. Estimated cost $250,000.

Que., Three Rivers—Canadian International Paper Co., Ltd., Sun Life Bldg., Montreal, plans to construct pulverizing and coal handling plants. Estimated cost $350,000.

CONTRACTS AWARDED

Calif., Berkeley—Linde Air Products Co., 1150 8th St., has awarded the contract for the construction of a warehouse to the Fluda Corp., 2500 South Atlantic St., Los Angeles. Estimated cost $40,000.

Calif., Oakland—West Coast Soap Co., 2501 Poplar St., will construct a 1 story warehouse. Work will be done by day labor. Estimated cost $60,000.

Idaho, Nampa—Amalgamated Sugar Co., H. A. Benning, Vice Pres. & Gen. Mgr., Ogden, will construct a sugar factory using company forces. Estimated cost $2,000,000.

N. J., Jersey City—Clorox Chemical Co., 51 Pacific Ave., has awarded the contract for a 1 and 2 story, 86x259 ft. warehouse addition to its factory to Bonanno Construction Co., Inc., 8533 Tonnelle Ave., North Bergen, at $153,000.

N. J., North Bergen—U. S. Rubber Co., 1435 51st St., Jersey City, has awarded the contract for two 1 story, 100x150 ft. and 100x200 ft. rubber goods factory additions to W. J. Lange, Inc., 1617 51st St. Estimated cost $175,000.

N. J., Pompton Lakes—E. I. du Pont de Nemours & Co., 71 Buckingham Pl., Perth Amboy, has awarded the contract for additions to its plant including 2 story, 64x86 ft. chemical building, etc., to Eastern Construction Co., 705 Greenwood Ave., Trenton.

N. Y., Massena—Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa., will construct a blooming mill here using its own forces. Project will be financed by Defense Plant Corp. Estimated will exceed $15,000,000.

N. Y., Niagara Falls—R. & H. Chemicals Div. of E. I. du Pont de Nemours, Inc., Wilmington, Del., has awarded the contract for an addition to its plant here to Laur & Mack Contracting Co., Inc., College Ave. Estimated cost $40,000.

O., Springfield—National Supply Co., 1401 Sheridan Ave., has awarded the contract for a research and testing laboratory and factory building to T. A. Thompson Construction Co., Chicago, Ill. Estimated cost $183,000.

Okla., Tulsa—Stanolind Oil & Gas Co., Philcade Bldg., has awarded the contract for 1 story, 50x70 ft., 36x80 ft. and 56x100 ft. geophysical and production laboratory additions at 1136 North Lewis Ave., to Waller-Wells Construction Co., 2423 East 13th Pl., at $121,641.

Ore., Portland—Electro Metallurgical Co., subsidiary of Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., has awarded the contract for a plant here to L. H. Hoffman Construction Co., 715 S. W. Columbia St., Portland. Estimated cost $250,000.

Pa., East Pittsburgh—Westinghouse Electric & Mfg. Co., East Pittsburgh, will construct an addition to its research laboratory. Work will be done by separate contracts. Estimated cost $55,000.

Pa., Reading—Wilhelm Paint Works, Div. of Glidden Co., 1801 North Third St., has awarded the contract for a research laboratory and locker building to L. H. Focht & Son, Inc., Baer Bldg., Reading. Estimated cost $75,000.

Tex., Texas City—Carbide & Chemicals Corp., subsidiary of Union Carbide & Carbon Co., 30 East 42nd St., New York, N. Y., has awarded the contract for an addition to its plant now under construction here to Ford, Bacon & Davis, 39 Bway., New York, N. Y. Estimated cost $350,000.

Wis., Merrimack—Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del., has awarded the contract for the construction of a powder plant for the War Dept., to Bechtel-McCone-Parsons Corp., 601 West 5th St., Los Angeles, Calif. Estimated cost including equipment $65,000,000.

Ont., Fort William—Great Lakes Paper Co., Ltd., Fort William, has awarded the contract for a digestor tower at the Westfort Plant to Barnett-McQueen Co., Ltd., 460 Christian St. Estimated cost including equipment $350,000.

Let's Take a Look at Tomorrow

» » TODAY almost all of us have two things on our minds—an all-out struggle to fill ever-increasing orders, and an intense interest in what may come after.

Hercules is working full-time on both. At the first hint of emergency, the output of almost everything we make was greatly increased; and since then we have endeavored to supply all of the demands made upon us.

At the same time, Hercules research was also expanded. A major share is being addressed to the problems of tomorrow. We are improving our present chemical materials and developing new ones to fit our customers' products for future demands.

The following three pages give some indication of what is going on. But for the full story, come to the Hercules booth at the Chemical Show. There you will find us eager to take a look at tomorrow—to discuss possibilities for strengthening *your* post-war drive for business through the use of Hercules materials. Not all are now available for non-defense production, but samples and technical cooperation will gladly be supplied. If you don't get in to see us at the Show, use the coupon.

PARLON PRIORITIES POINT TO FUTURE PROFITS

Defense requirements are now taking all the Parlon that we can produce. But that does not discourage men who are looking ahead. They realize that the very qualities which have brought Parlon completely into the defense program are compelling evidence of its post-war value.

Makers of enamels will value Parlon as a fortifying agent—to make finishes that dry in half the normal time (whether baked or air-dried). Users will prefer these Parlon-fortified coatings that give their products a tougher, more resistant finish, and better-looking too. Manufacturers of paints will rely on Parlon as an alkali-resistant film-former. Users will value such paints for concrete and masonry. Similarly, other manufacturers will come to Parlon for the things it alone can do. The most forward-looking of these are now assembling their facts and preparing the groundwork for profits in the future.

WHAT YOU CAN LEARN FROM HAIRLESS PIGS

When meat-packers send their pigs to market, they naturally want as many of them as possible to be graded "A." The job is done neatly, quickly, and efficiently with Brisgo*—another of the many materials for industry derived from the oleoresin of the pine stump. It takes out the hairs and bristles—even the roots—and eliminates unsightly nicks and scratches. Meat-packers like the net result, because it's a big help in getting top grades out of inspectors.

So hairless pigs are here to stay—thanks to this material. And many another aid to production may develop in similar fashion, out of our desire to put Hercules chemical materials to work for industry. If you want to see how Brisgo helps meat-packers, write for the book "This Little Pig Went To Market." Or, if you would like some similar help in other phases of industry, let's put our heads together on that, too.

*Reg. U. S. Pat. Off., by Hercules Powder Company

WINNING NEW BUSINESS AGAINST THE CLOCK

Speed for defense—that's the secret behind the all-out capacity production of nitrocellulose. For nitrocellulose lacquers provide the fastest finishing schedules known—vital for parts and products where every second counts.

Under this time-pressure, nitrocellulose has taken every market that productive capacity allows. And most of these markets will continue, when normal business returns, to demand the speedy drying, toughness, durability, and overall economy that nitrocellulose lacquer provides.

OLD MAN WINTER CAN'T DO THIS TO US!

Old Man Winter sure makes trouble for concrete roads. With water turning to ice and back again so rapidly under the influence of ice-removing chemicals—developing pressures up to 15,000 pounds per square inch of area in cracks and fissures—it's no wonder that road-surfaces become scaly and rough-riding.

But now there's an answer. Special cements, treated with minute amounts of Hercules Vinsol* Resin during clinker-grinding, are able to resist the attacks of Old Man Winter for far longer times. Many tests have proved this—highway engineers are using Vinsol-treated cements—and Hercules chemistry has helped to win another battle for more comfort and convenience at lower cost.

THE FUTURE OF ETHYL CELLULOSE IS ALREADY HERE

Only a few years ago, ethyl cellulose was hailed as "the cellulosic material of the future." Today, the heightened pace of industry has crowded the calendar so fast that the future for this material is already here. Industry after industry has adopted this Hercules chemical material, and the "advantageous properties" of yesterday are the "reasons why" right now.

Ethyl cellulose is, like all Hercules cellulose derivatives, remarkably tough and flexible—and is unique in retaining these physical advantages under heat or extreme cold. It is completely soluble in low-cost solvents. It is compatible with many materials, from nitrocellulose to waxes, oils, and resins. It is free from discoloration by sunlight, and has a very low burning rate. Finally, it has good electrical properties.

Until a short time ago, these were advantages promised for the future. Now they are being realized, every day, in many industries. Perhaps, in your own planning for the future, you should make use of the "reasons why," and investigate Hercules Ethyl Cellulose.

TO EASE THE SQUEEZE ON ROSIN

If you can use a dark-colored resin, here's good news. There's a plentiful supply of Belro* Resin at an attractive price.

Belro is now successfully used for dark soaps, varnishes, and paints; and in thermoplastic compounds for phonograph records, dry battery waxes, floor tile, box toes, grinding wheels, and electrical insulating compounds. The existing rosin situation and the future outlook call for a wider use of Belro, with decided advantage to those who are first to fit it into their processes.

Specifications: Acid number, 118; saponification number, 150; melting point (drop), 187° F.; gasoline insoluble, 60%; unsaponifiable matter, 12.0%; color, dark; ash content, 0.03%.

Write for a sample.

*Reg. U. S. Pat. Off., by Hercules Powder Company

TRULINE BINDER GETS 'EM UP THERE FASTER

"Keep them flying" starts in the foundry. For engine parts, cylinder heads, sumps, wheels, and many other aircraft parts are *cast*—mostly out of non-ferrous alloys which are a bit ticklish to work with.

Here's where Truline* Binder comes in. Cores bonded with this Hercules material are just the thing for castings of magnesium or aluminum alloys, because they collapse so fast there's little chance for core resistance to cause shrinkage cracks.

There are other advantages, too. Cleaning time is reduced. Shorter bakes give you more cores per oven. And, an added advantage for magnesium: you can put inhibitors right in the mix, because Truline-bonded cores will develop full strength at baking temperatures as low as 300° F.

All this adds up to more sound finished castings . . . turned out faster . . . at lower cost. We'll be glad to send you full information—whether you're casting magnesium, aluminum, brass, bronze, grey or malleable iron or steel. Use the handy coupon.

VINSOL RESIN

HAVE YOU TRIED IT LATELY FOR PAINTS?

If you haven't tried Vinsol* Resin recently you may be missing a chance to save money and improve some types of finishes. For certain dark-colored paints and lacquers this new, low-cost resin is filling a need, both because of its valuable properties and because it is available for immediate delivery in any quantities.

Vinsol naturally suggests use in dark paints, freight car sealers, tank car paints, barn paints, and dark lacquers. A study of its characteristics will also suggest other applications. We'll gladly send you as large a sample as you need for testing Vinsol in your formulations.

NO SKIN— NO CAKE— NO SAG—

In many synthetic-resin varnishes, Dipentene No. 122* is recommended as the solvent. This Hercules chemical solvent is a good anti-skinning agent, and produces exceptionally smooth-flowing, easy-brushing varnishes. Films harden at a uniform rate, reducing wrinkling tendencies.

Hercules Dipentene No. 122 also exerts a wetting action on pigments. This property makes it a valuable additive in pigment-grinding operations, and promotes stable suspensions with a minimum of settling and caking in the finished enamel. These combined advantages are especially important now because of shortages and high cost of many standard thinners.

*Reg. U. S. Pat. Off., by Hercules Powder Company

This solvent is just one of eight Hercules terpene chemicals—each with its own special combination of solvency, boiling point, and evaporation rate. Some have been used in industry with growing success for years—some have just recently been introduced and are rapidly winning their spurs. When you're looking for a solvent for resins and oils, with wetting action thrown in, these terpene solvents are worth looking into.

WHY SO MANY AWARDS TO CELLULOSE ACETATE PLASTICS?

Every year, manufacturers vie with each other in open competition for a series of awards by Modern Plastics Magazine, denoting the most effective, original, and striking uses of plastics in commercial production. This year, cellulose acetate plastics took more prizes than ever before. Jewelry, cash registers, Christmas tree ornaments, flashlights, airplane bomber window frames, shoe-lace dispensers, printing plates, children's blocks, and traffic safety-dot markers—all made of cellulose acetate—were among the prize winners.

There are four very good reasons why cellulose acetate plastics took all these awards. These are the four basic properties of cellulose acetate—toughness, beauty, economy, versatility. Cellulose acetate plastics are tough, shock-resistant, strong in thin sections, capable of design for full strength. They are beautiful with an unlimited range of colors *and* transparencies, and with a smooth, warm, glossy feel for rich appeal to the senses. They are economical, rapidly formed in automatic molding machines, and require almost no finishing. They are versatile, because by proper choice of flake and formulation a range of properties is available which, in the hands of a skilled designer, can answer most any problem. That's why so many manufacturers are staking their future on this amazing material.

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WEEK OF DECEMBER 1st, 1941

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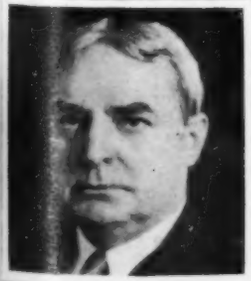

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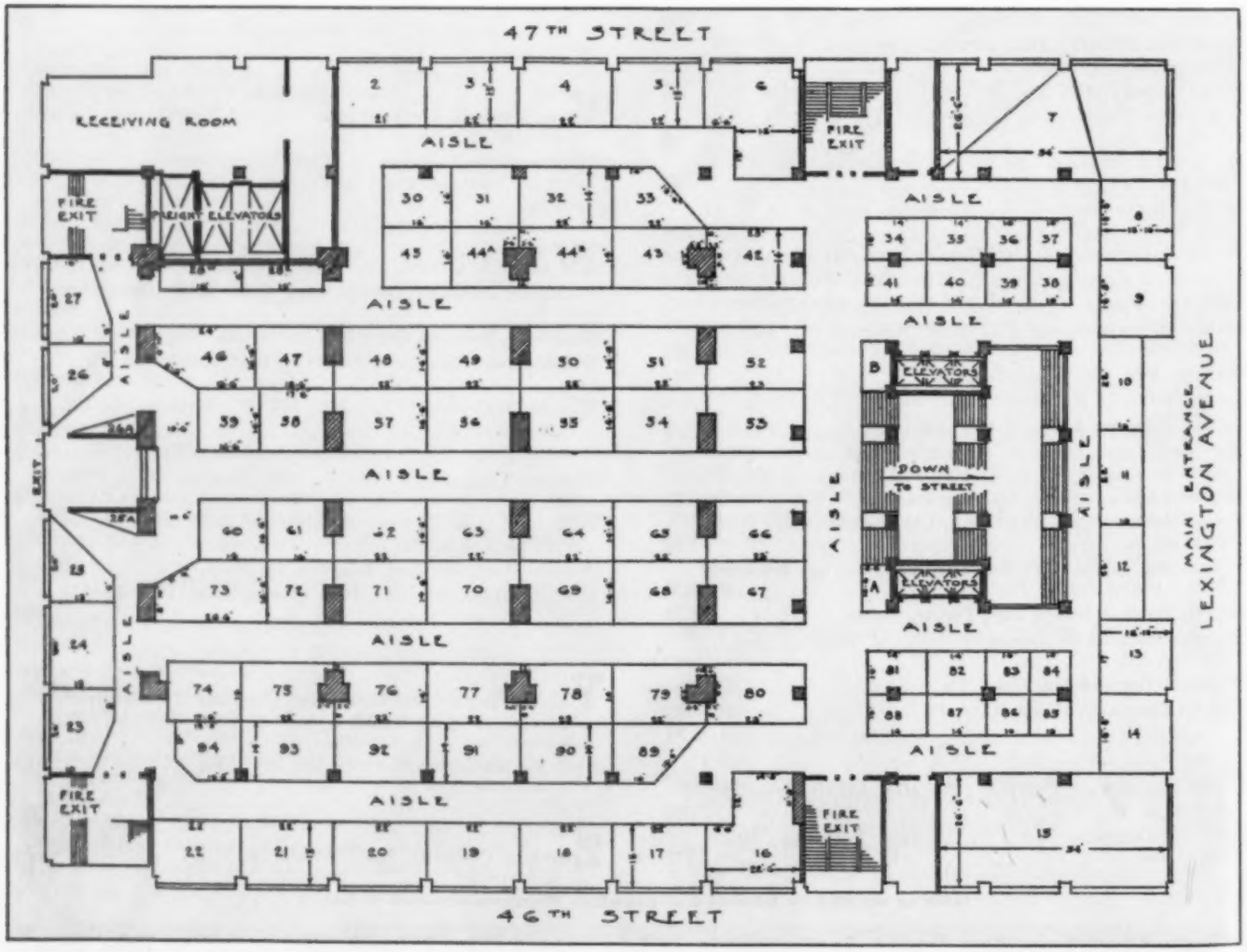

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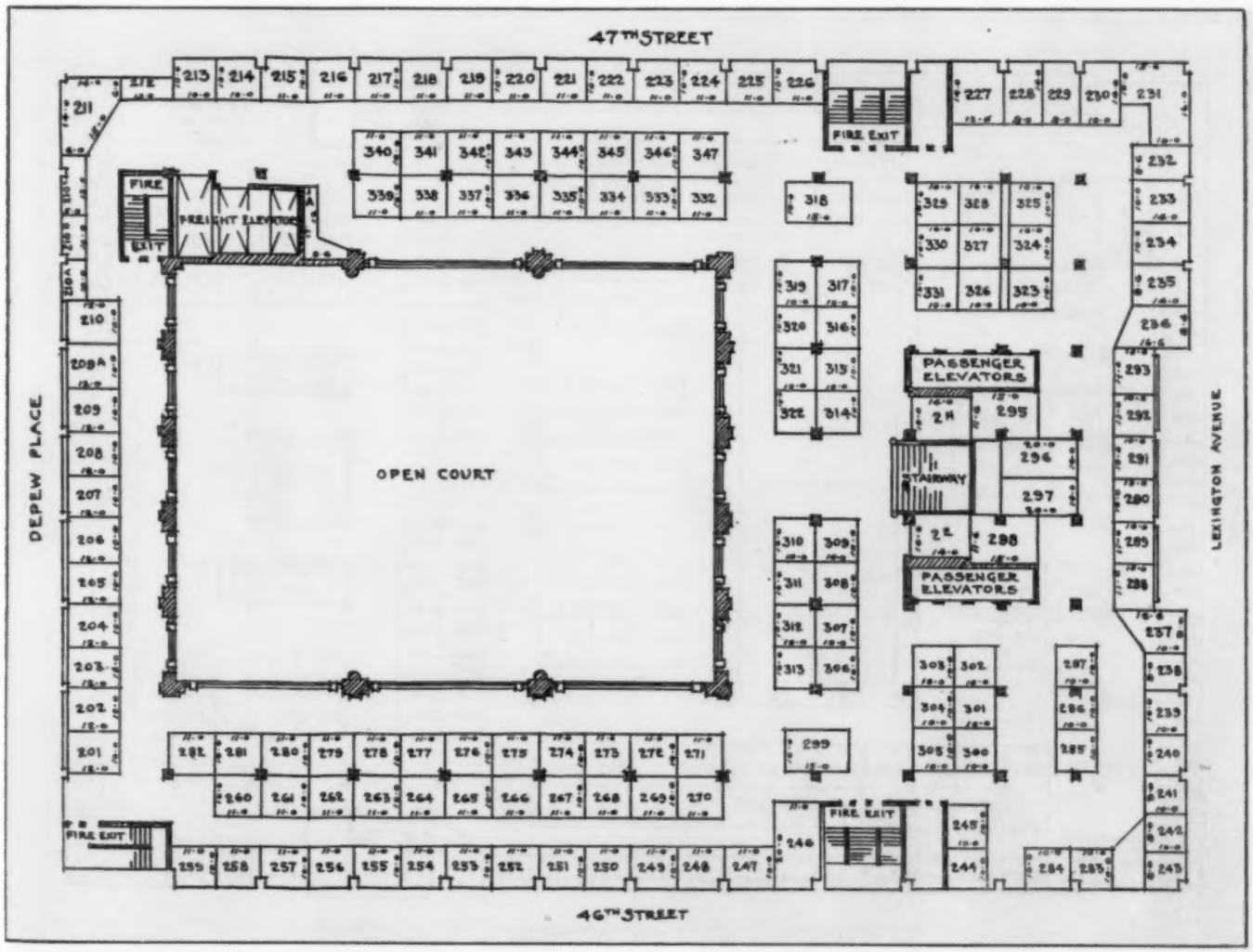

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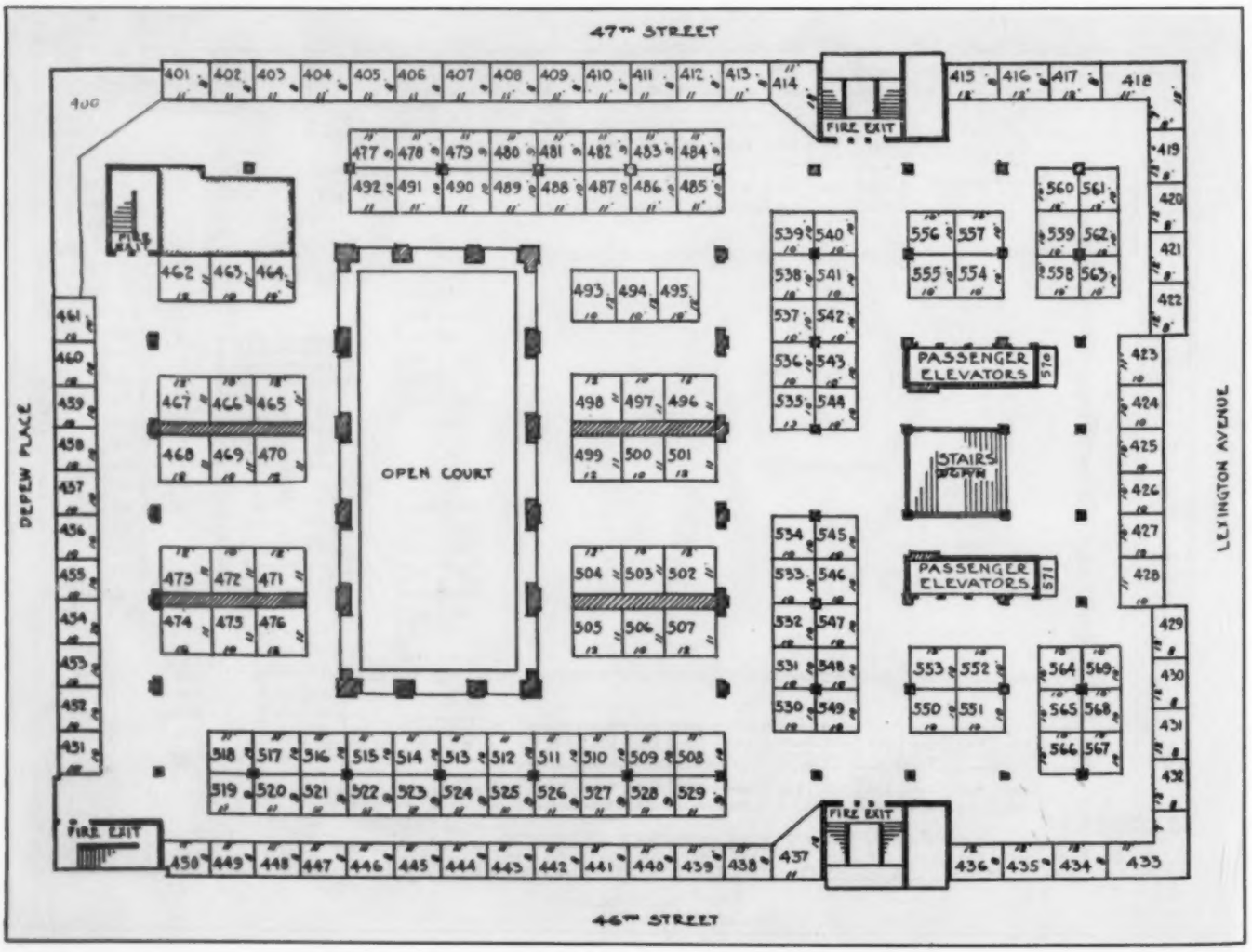

EXHIBITORS BY CLASSIFIED PRODUCTS

ABRASIVES
American Foundry Equipment Co.
Carborundum Co.
Dicalite Co. (polish)
Dorr Co., Inc.
Norton Co.
Pangborn Corp. (steel)
Paper & Industrial Appliances, Inc.
Separations Engineering Corp.

ACIDS
Atlas Powder Co.
Darco Corp.
Eimer & Amend
Koppers Co.
Chas. Pfizer & Co., Inc. (ascorbic, citric, tartaric, gluconic)

ACIDIFIERS
General Ceramics Co.
Patterson-Kelley Co., Inc.
Sprout, Waldron & Co.

ACID PLANTS
Buffalo Foundry & Machine Co.
Electro Chemical Supply & Engrg. Co.
Fansteel Metallurgical Corp.
General Ceramics Co.
Maurice A. Knight
Koppers Co.
Quigley Co., Inc.
United States Stoneware Co.

ACID RESISTING MATERIALS
Allegheny Ludlum Steel Corp.
Aluminum Co. of America
American Hard Rubber Co.
American Smelting & Refining Co.
Baker & Co., Inc. (platinum & platinum clad chemical equip.)
Corning Glass Works
Duriron Co., Inc.
Electro Chemical Supply & Engrg. Co.
Ertel Engineering Corp.
Fansteel Metallurgical Corp.
General Alloys Co. (cast)
General Ceramics Co.
Haynes Stellite Co.
Ingersoll Steel & Disc. Div. Borg-Warner Corp.
International Nickel Co.
Maurice A. Knight
Laboratory Furniture Co.
Lapp Insulator Co.
Lebanon Steel Foundry
Lukens Steel Co.
Marlo Co.
National Carbon Co. (carbon, graphite, Karbate)
Paramount Rubber Co.
Pfaudler Co.
Pioneer Rubber Co.
Protective Coatings, Inc.
Quigley Co., Inc.
Selas Co.
E. H. Sheldon & Co.
Synthane Corp.
United States Stoneware Co.

ADHESIVES
American Resinous Products Corp.
Bay State Chemical Co.
Casein Co. of America, Div. of the Borden Co. (waterproof resins glues, cements, water resistant casein glues, casein, latex cements, ice water proof labeling pastes)
Edward Ermold Co.

AGITATORS
Abbe Engineering Co.
Alsop Engineering Corp.
American Smelting & Refining Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co.
Denver Equip. Co.
Dorr Co., Inc.
Dover Boiler & Plate Fabricators, Inc.
Eastern Engineering Co.
Eppenbach, Inc.
Ertel Engineering Corp.
General Ceramics Co.
Hardinge Co., Inc.
Hendrick Mfg. Co.
Kent Machine Works, Inc.
L. O. Koven & Bro., Inc.
Lee Metal Products Co., Inc. (scraper type motor, belt driven for steam jacketed kettles)
Luzerne Rubber Co. (hard rubber)
Mixing Equipment Co., Inc.
National Engineering Co.
New England Tank & Tower Co.
Patterson-Kelley Co., Inc.
Pfaudler Co.
Read Machinery Co., Inc.
Robinson Mfg. Co.
Sowers Mfg. Co.
Sprout, Waldron & Co.
Turbo-Mixer Corp.
United States Stoneware Co.

AIR CONDITIONING APPARATUS
Air & Refrigeration Corp.
Thomas A. Edison, Inc., Instrument Div. (railway control)
General Electric Co.
Grinnell Co., Inc.
Reeves Pulley Co.
York Ice Machinery Corp.

AIR TABLES
Separations Engineering Co.
Sutton, Steele & Steele, Inc.

ALCOHOL
Commercial Solvents Corp.
Eimer & Amend

ALKALIES
Eimer & Amend
Niagara Alkali Co.

ALLOYS—Ferrous
American Smelting & Refining Co.
Dover Boiler & Plate Fabricator, Inc.
Duriron Co., Inc.
General Alloys Co. (cast)
Ingersoll Steel & Disc Div., Borg-Warner Corp.
L. O. Koven & Bro., Inc.
Lebanon Steel Foundry
Titanium Alloy Mfg. Co.
United States Steel Corp.

ALLOYS—Non-Ferrous
Allegheny-Ludlum Steel Corp.
Aluminum Co. of America
American Smelting & Refining Co.
Baker & Co., Inc. (platinum metals, gold & silver)
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
Fansteel Metallurgical Corp.
Haynes Stellite Co.
Hills McCanna Co.
International Nickel Co.
Koppers Co.
L. O. Koven & Bro., Inc.
Titanium Alloy Mfg. Co.

AMMONIATORS
Wallace & Tiernan Co., Inc.

ANODES
Baker & Co., Inc. (insoluble platinum & platinum clad silver & gold)
Duriron Co., Inc.

ASBESTOS
American Seitz Filter Corp.
Ertel Engineering Corp.
Garlock Packing Co.
Johns-Manville

AUTOCLAVES
American Instrument Co.
American Smelting & Refining Co.
C. O. Bartlett & Snow Co.
Black, Sivalls & Bryson, Inc.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
E. G. Budd Mfg. Co.
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
General Ceramics Co.
Hendrick Mfg. Co.
Henry E. Jacoby
L. O. Koven & Bro., Inc.
Patterson-Kelley Co., Inc.
Pfaudler Co.
Sowers Mfg. Co.
United States Stoneware Co.

AUTOMATIC TEMPERATURE CONTROL
American Instrument Co.
Eastern Engineering Co.
Charles Engelhard, Inc.
General Electric Co.
Sarco Co., Inc.

BAGS
Bemis Bro. Bag Co.
Fulton Bag & Cotton Mills (cotton, burlap, waterproof, paper lined in burlap & cotton, seamless bags, cotton twine & thread)
St. Regis Paper Co. (paper)
Union Bag & Paper Co.

BALANCES AND WEIGHTS
American Instrument Co.
Eimer & Amend
Scientific Glass Apparatus Co.
Seederer-Kohlbusch, Inc.
Toledo Scale Co.

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BARRELS AND DRUMS

Aluminum Co. of America
Associated Cooperage Industries of America (wooden barrels and kegs, tight and slack)
E. G. Budd Mfg. Co.
Carpenter Container Co. (fiber drums for dry products, semi-liquids dangerous articles)
Pressed Steel Tank Co.
Container Co.

BASKETS—Dipping

American Hard Rubber Co.
S. Blickman, Inc. (stainless steel)
E. G. Budd Mfg. Co.
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
Falstrom Co.
General Alloys Co.
General Ceramics Co.
Maurice A. Knight
L. O. Koven & Bro., Inc.
Luzerne Rubber Co.
Paramount Rubber Co.
Protective Coatings, Inc.
United States Stoneware Co.

BATTERIES

Owens-Corning Fiberglas Corp.

BATTERY PARTS

American Hard Rubber Co.
Luzerne Rubber Co.

BEARINGS

Buffalo Foundry & Machine Co.
Great Western Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Reeves Pulley Co.
Sprout, Waldron & Co.
Stephens-Adamson Mfg. Co.
Westinghouse Elec. & Mfg. Co.

BELTS

Garlock Packing Co.
Great Western Mfg. Co.
Reeves Pulley Co.
Stephens-Adamson Mfg. Co.

BLOWERS

Beach-Russ Co. (rotary)
Duriron Co., Inc. (acid resisting, laboratory)
General Ceramics Co. (armored stoneware)
Jeffrey Mfg. Co. (aerodyne)
Laboratory Furniture Co. (Laboratory)
United States Stoneware Co. (acid)

BOILERS

Dover Boiler & Plate Fabricators, Inc.
Eclipse Fuel Engineering Co.
L. O. Koven & Bro., Inc.
National Carbon Co. (Karbate)

BOILER COVERING & INSULATION

Dicalite Co.
Johns-Manville
Quigley Co., Inc.

BOLTING CLOTH

Abbe Engineering Co.
Great Western Mfg. Co.
Gump, B. F.
Newark Wire Cloth Co.
Richmond Mfg. Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
W. S. Tyler Co.

BOOKS—Technical

Allegheny-Ludlum Steel Corp.
Interscience Publishers, Inc.
McGraw-Hill Book Co., Inc.
Reinhold Publishing Corp.
D. VanNostrand Co., Inc.

BOTTLING MACHINERY

Alsop Engineering Corp.
Economic Machinery Co.
Elgin Mfg. Co.
Edward Ermold Co.
Ertel Engineering Corp.
Horix Mfg. Co.
Karl Kiefer Machine Co. (auto. and semi-automatic for filling, closing, conveying)
PerfeKtum Products Co.
Pneumatic Scale Corp. Ltd.
Reeves Pulley Co. (equipment for)

BRICK—Acid Proof

Electro-Chemical Supply & Engrg. Co.
General Ceramics Co.
Maurice A. Knight
Lapp Insulator Co.
Quigley Co., Inc.
National Carbon Co. (carbon and graphite)
United States Stoneware Co.

BRICK—Insulating

Aluminum Co. of America
Carborundum Co.
Johns-Manville
Quigley Co., Inc.
Titanium Alloy Mfg. Co.

BRICK—Refractory

Aluminum Co. of America
Carborundum Co.
Johns-Manville
Norton Co.
Quigley Co., Inc.
Selas Co.
Titanium Alloy Mfg. Co.
United States Stoneware Co.

BRIQUETTING and TABLET MAKING MACHINERY

Reeves Pulley Co.
Robinson Mfg. Co.
F. J. Stokes Machine Co.

BUCKETS—Elevator

C. O. Bartlett & Snow Co.
Falstrom Co.
Great Western Mfg. Co.
Gump, B. F.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
National Engineering Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
Stephens-Adamson Mfg. Co.

BUCKETS—Clamshell

Blaw-Knox Co.

BUILDING MATERIALS

Allegheny Ludlum Steel Corp.
Blaw-Knox Co.
Electro Chemical Supply & Engrg. Co.
Johns-Manville
United States Steel Corp.
Walworth Co. (floor plates, cast iron)

BUILDINGS

Blaw-Knox Co. (industrial steel)

BURNERS

Eimer & Amend
Selas Co.

CATALYSTS

Baker & Co., Inc. (platinum and palladium)

CAUSTIC POTS

Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
Goslin-Birmingham Mfg. Co.
L. O. Koven & Bro., Inc

CELLULOSE

Hercules Powder Co.

CEMENT

Carborundum Co. (refractory)
Electro Chemical Supply & Engrg. Co. (acid proof)
General Ceramics Co. (acid proof)
Hercules Powder Co. (cellulose derivatives)
Johns-Manville (asbestos)
Maurice A. Knight
National Carbon Co. (carbon filler)
Norton Co. (refractory)
Quigley Co., Inc.
United States Stoneware Co. (acid)

CENTRIFUGALS

American Machine & Metals, Inc.
Baker Perkins Co.
Bird Machine Co.
Fletcher Works, Inc.
Lebanon Steel Foundry
Luzerne Rubber Co. (pumps, hard rubber)
Reineveld Corp.
Sharples Corp.

CABINETS—Chemical, Filing & Laboratory

Alberene Stone Corp. of Va.
Kewaunee Mfg. Co.
Laboratory Furniture Co.
Leonard Peterson & Co., Inc.
E. H. Sheldon & Co.

CALCINERS

C. O. Bartlett & Snow Co.
Hardinge Co., Inc.
Louisville Drying Machinery Co.

CALORIMETERS

American Instrument Co.
American Meter Co.
Eimer & Amend

CANS

S. Blickman, Inc. (stainless steel, various sizes & shapes)
Economic Machinery Co.

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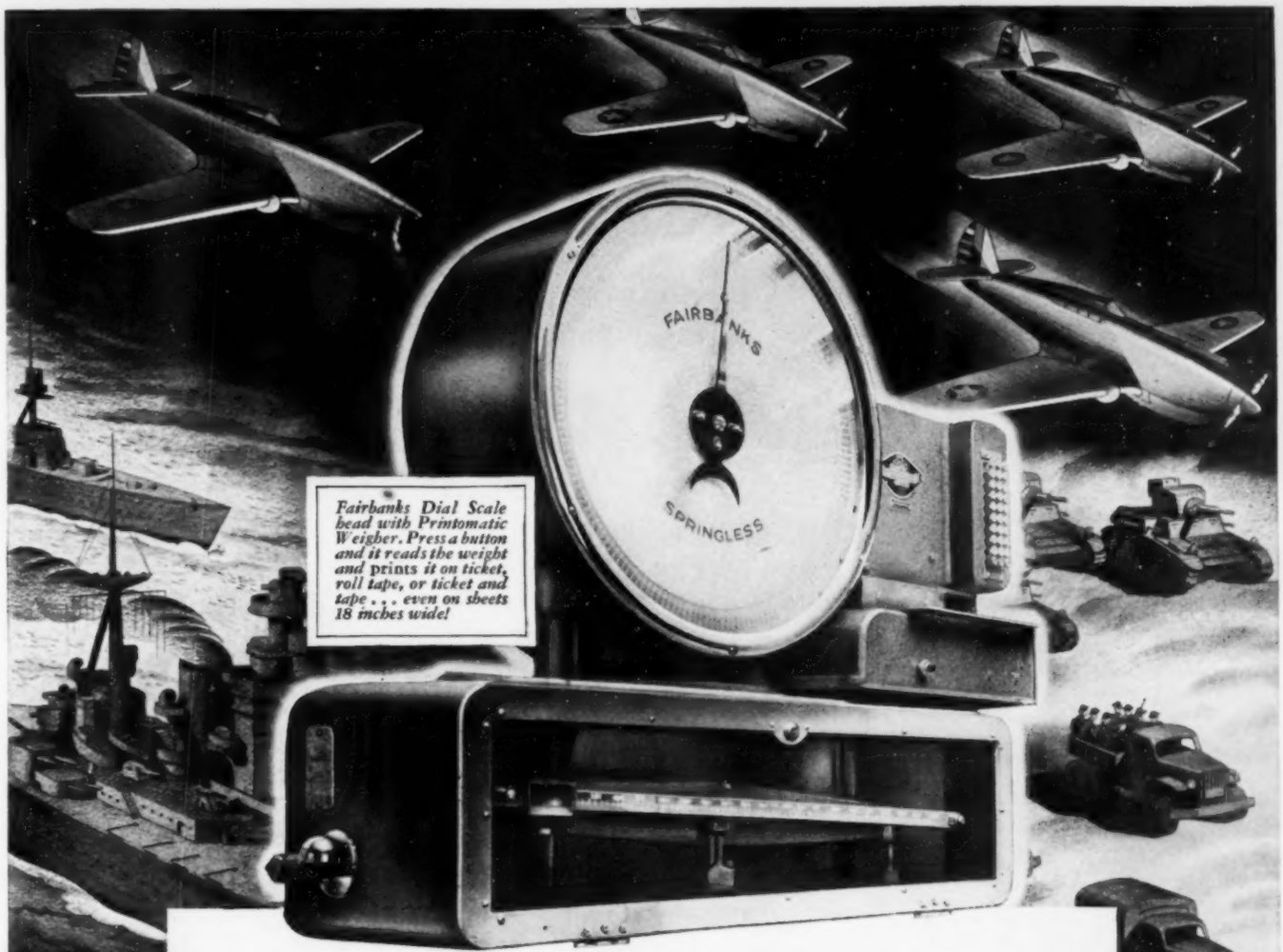

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DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

CAPPING MACHINES
Elgin Mfg. Co.

CARBON
Commercial Solvents Corp. (blacks)
National Carbon Co. (graphite)

CARBOY TILTERS
Barrett-Cravens Co.
Economy Enginering Co.
Eimer & Amend
Revolvator Corp.

CARBOY HANDLERS
Barrett-Cravens Co. (pourers, trucks)

CARS—Tank
American Smelting & Refining Co.
Pfaudler Co.

CASTINGS
Allegheny-Ludlum Steel Corp. (stainless)
Aluminum Co. of America (aluminum)
American Smelting & Refining Co. (lead)
Blaw-Knox Co. (steel and alloy)
Buffalo Foundry & Machine Co. (gray iron, bronze, chemical)
Duriron Co., Inc. (Duriron, Durichlor, Durimet, Low-carbon, Chrome-nickel steels, Alcumite)
General Alloys Co. (heat, corrosion & abrasion resistant)
Goslin-Birmingham Mfg. Co.
Great Western Mfg. Co. (gray iron)
Haynes Stellite Co. (abrasion & corrosion resisting alloy)
Hills-McCanna Co. (Dowmetal, Magnesium alloy, aluminum bronze, Manganese bronze)
International Nickel Co. (nickel & nickel alloy)
Koppers Co. (non-ferrous, gray iron, steel)
Lebanon Steel Foundry (acid resisting, stainless, corrosion resistant for chemical equipment manufacturers)
Link-Belt Co.
Robinson Mfg. Co. (gray iron)
Sivyer Steel Casting Co.
Sprout, Waldron & Co. (gray and white iron)
United States Steel Corp. (steel)
Waukesha Foundry Co. (corrosion resisting, sand castings, "Waukesha" metal, copper, nickel alloy, monel, pure nickel, bronze and aluminum alloys)

CERAMICS
General Ceramics Co.
Maurice A. Knight
Lapp Insulator Co.
Selas Co.
Titanium Alloy Mfg. Co.
United States Stoneware Co.

CHEMICAL PLANT EQUIPMENT
Alberene Stone Corp. of Va.
Aluminum Co. of America
Alsop Engineering Corp.
American Hard Rubber Co.
American Instrument Co.
American Seitz Filter Corp.
Baker & Co., Inc. (platinum and platinum clad)
Baker Perkins, Inc.
C. O. Bartlett & Snow Co.
Black, Sivalls & Bryson, Inc.
Blaw-Knox Co. (impregnating equipment)
S. Blickman, Inc. (stainless steel processing vessels, agitators, condencers, evaporators, kettles, cookers)
E. G. Budd Mfg. Co.
Buffalo Foundry & Machine Co.
Coleman Electric Co., Inc.
Corning Glass Works
Dorr Co., Inc.
Duriron Co., Inc.
Electro Chem. Supply & Engrg. Co.
Eppenbach, Inc.
Falstrom Co.
Fansteel Metallurgical Corp.
Federal Classifier Systems, Inc.
Fischer & Porter Co. (flow meters)
General Ceramics Co.
Goslin-Birmingham Mfg. Co.
Graver Tank & Mfg. Co., Inc.
Great Western Mfg. Co.
Gump, B. F.
Hardinge Co., Inc.
Hanovia Chemical & Mfg. Co.
Hendrick Mfg. Co. (sulphonators, oil blowing, chlorinators, paint thinning, reactors, blending)
International Nickel Co.
Henry E. Jacoby
Jeffrey Mfg. Co.
Maurice A. Knight
Koppers Co.
Lancaster Iron Works (filters, kettles, pots, porcelain ware)
Lewis-Shepard Sales Corp. (handling)
Louisville Drying Machinery Co.
Luzerne Rubber Co. (hard rubber)
Magnetic Enginering & Mfg. Co.
Marlo Co.
Mixing Equipment Co., Inc.
Monarch Mfg. Works, Inc.
National Engineering Co.
National Carbon Co. (carbon, graphite, Karbate)
New England Tank & Tower Co.
Patterson-Kelley Co., Inc.
Pfaudler Co.,
Premier Mill Corp.
Productive Equipment Co.
Pulverizing Machinery Co.
Read Machinery Co., Inc.
Reeves Pulley Co.
Richmond Mfg. Co.
Robinson Mfg. Co.
Schutte & Koerting Co.
Selas Co.
Sharples Corp.
Sowers Mfg. Co.
Sprout-Waldron & Co.
Stephens, Adamson Mfg. Co.
F. J. Stokes Machine Co.
Syntron Co.
Toledo Scale Co.
W. S. Tyler Co.
United States Stoneware Co.
Westinghouse Electric & Mfg. Co.
E. H. Sheldon & Co.

CHEMICAL STONEWARE—Acid Proof
Electro Chemical Supply & Engrg. Co.
General Ceramics Co.
Maurice A. Knight
Laboratory Furniture Co.
Monarch Mfg. Works, Inc.
Norton Co.
Selas Co.
United States Stoneware Co.

CHEMICALS—Industrial
American Resinous Products Co.
Atlas Powder Co.
Bay State Chemical Co.
Casein Co. of America, Div. of The Borden Co. (casein, transparent, flexible, liquid-core wash, binders, spray, plasticizers, synthetic resin, resin emulsions
Commercial Solvents Corp. (nitroparaffine & derivitives, nitrohydroxy, aminohydroxy, hydroxylamin, acetone, butanol, plasticizers, methanol, anti-freezes)
Darco Corp.
Glyco Products Co., Inc. (foaming agents, anti-foaming, synthetic waxes, preservatives, water soluable waxes and resins, wetting agents, emulsions)
Hercules Powder Co. (paper)
Koppers Co.
Neville Co. (coal tar)
Niagara Alkali Co.
Chas. Pfizer & Co., Inc. (riboflavin, tartar, gluconates, iodides, bismuth, salts, mercurials, oxalates)
Sealtest, Inc. Research Labs. (calcium lactate, lactic acid, sodium lactate, lactose, casein, lactate salts)
Titanium Alloy Mfg. Co.

CHEMICALS—Laboratory
Axiom Chemical Co.
Eimer & Amend
W. A. Hammond Drierite Co.
Chas. Pfizer & Co., Inc. (riboflavin, tartar, citrates, iodides, bismuth salts, mercurials, oxalates)
Titanium Alloy Mfg. Co.

CHEMISTS
E. H. Sheldon & Co.
Foster D. Snell, Inc.

CHLORINATORS
Graver Tank & Mfg. Co., Inc. (gas, solution, electric)
Wallace & Tiernan Co., Inc.

CLARIFIERS
Baker Perkins Co. (centrifugals)
Bird Machine Co.
Dorr Co., Inc.
Ertel Engineering Corp.
Fletcher Works, Inc.
Graver Tank & Mfg. Co., Inc.
Hardinge Co., Inc.
Reineveld Corp. (centrifugals)
Selas Co.
Sharples Corp.

CLASSIFIERS
Bird Machine Co.
Denver Equip. Co.
Dorr Co., Inc.
Federal Classifier Systems, Inc. (air)
Hardinge Co., Inc.
Paper & Industrial Appliances, Inc. (fibre)
Robinson Mfg. Co.

CLUTCHES
Jeffrey Mfg. Co.

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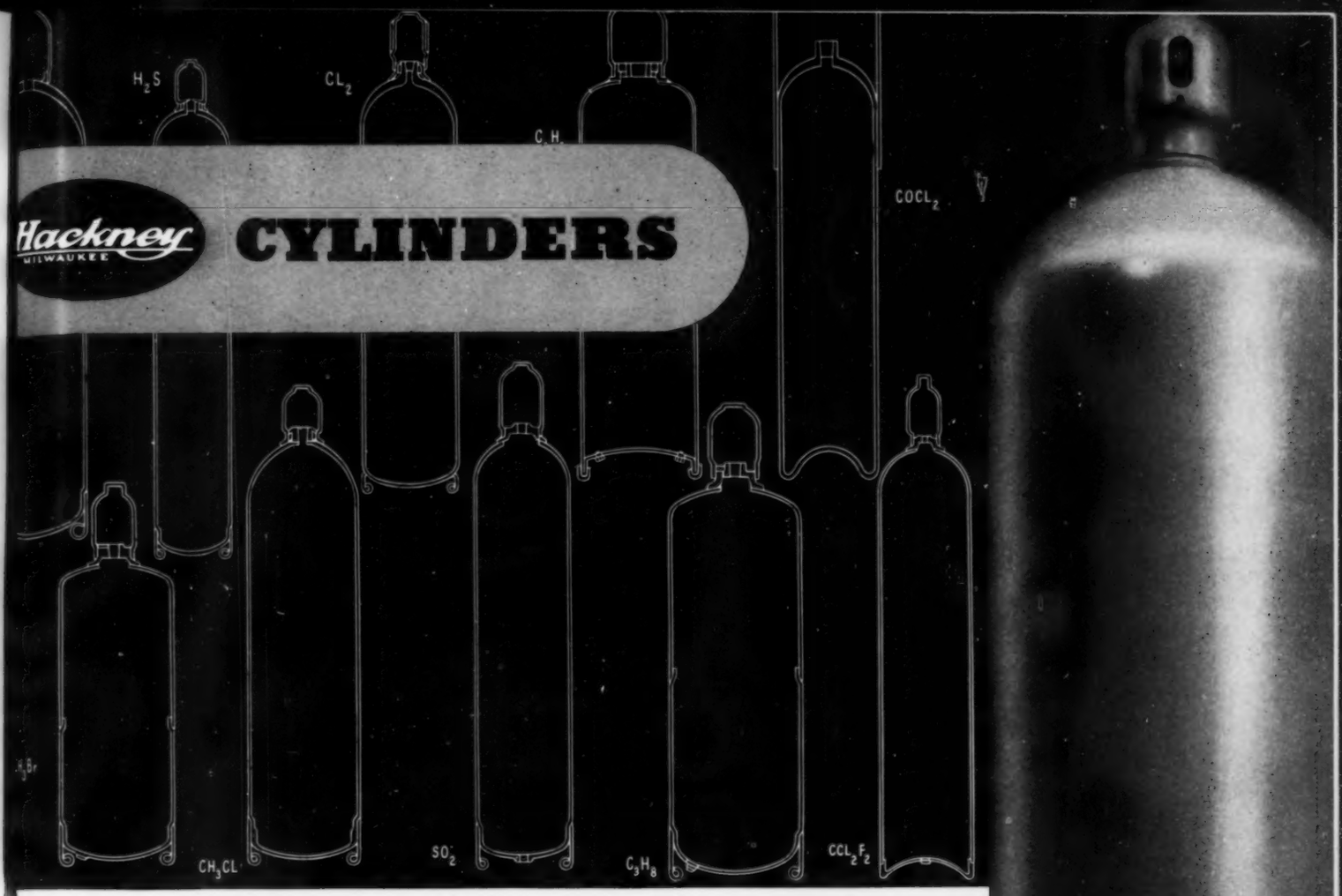

Hackney Design and Manufacturing Methods Assure Economy and Dependability

● Container problems involving the shipment of many types of gases have been solved through Hackney design and manufacturing methods. Maximum economy and utmost dependability are assured by Hackney's advanced heat-treating methods, thorough testing, careful selection of raw materials and complete understanding of each requirement.

Pressed Steel Tank Company has pioneered many improvements and developments in cylinder design and construction. As a result, the transporting and storing of gases today has been made more economical, safer and easier.

Hackney engineers will gladly cooperate with you in determining the most practical and economical cylinder for your individual needs. It may lead to faster, safer shipments and important cost reductions. Why not send today for full information? There is no obligation.

●

See our exhibit at the 18th Exposition of Chemical Industries—Grand Central Palace, New York—December 1st to 6th, 1941 — Booths 280, 281, 282.

PRESSED STEEL TANK COMPANY

1325 VANDERBILT CONCOURSE BLDG., NEW YORK
208 S. LA SALLE STREET, ROOM 1549, CHICAGO
1447 S. 66TH STREET, MILWAUKEE, WISCONSIN
667 ROOSEVELT BUILDING, LOS ANGELES, CALIF.

CONTAINERS FOR GASES, LIQUIDS AND SOLID

Kinney Mfg. Co.
Link-Belt Co.

COILS

American Smelting & Refining Co.
Dover Boiler & Plate Fabricators, Inc.
General Ceramics Co.
L. O. Koven & Bro., Inc.
National Carbon Co. (Karbate & graphite)
John A. Roebling's Sons Co.
United States Stoneware Co.
Walworth Co. (fabricated pipe)

COKE OVEN MACHINERY

Koppers Co.
Reeves Pulley Co.
Sharples Corp.

COLLECTORS

E. G. Budd Mfg. Co.
Federal Classifier Systems, Inc. (dust)
Gruendler Crusher & Pulv. Co.
Pangborn Corp. (dust)
Robinson Mfg. Co.
Claude B. Schneible Co. (dust)
Sprout-Waldron & Co.
Westinghouse Electric & Mfg. Co. (dust)

COLLOID MILLS

C. O. Bartlett & Snow Co.
Chemicolloid Laboratories, Inc.
Eppenbach, Inc.
Pfaudler Co.
Premier Mill Corp.

COLOR FILTERS

Corning Glass Works (glass)

COLORIMETERS

American Instrument Co.
Coleman Electric Co., Inc.
Eimer & Amend
Fischer & Porter Co.
General Electric Co.
National Technical Laboratories
PerfeKtum Products Co.
Photovolt Corp.
Scientific Glass Apparatus Co.
W. A. Taylor & Co.

COMPRESSORS

Beach-Russ Co.
Fuller Co.
Matheson Co., Inc. (for gases)
Nash Engineering Co. (air and gas, acid resisting, clean air, chlorine)

CONDENSERS

Aluminum Co. of America
American Smelting & Refining Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co.
Corning Glass Works (glass)
Dover Boiler & Plate Fabricators, Inc.
Fansteel Metallurgical Corp.
General Ceramics Co.
General Electric Co.
Henry E. Jacoby
Kimble Glass Co. (glass)
L. O. Koven & Bro., Inc.
National Carbon Co. (Karbate)
Patterson-Kelley Co., Inc.
Pfaudler Co.
F. J. Stokes Machine Co.
Westinghouse Electric & Mfg. Co.

CONTACTORS

Blaw-Knox Co.
General Ceramics Co.
General Electric Co.
Westinghouse Electric & Mfg. Co. (electric)

CONTAINERS

Aluminum Co. of America
American Hard Rubber Co.
S. Blickman, Inc. (stainless steel)
Carpenter Container Co. (fiber drums for dry products, semi-liquid and dangerous articles)
Dover Boiler & Plate Fabricators, Inc.
L. O. Koven & Bro., Inc.
Luzerne Rubber Co. (hard rubber)
Pressed Steel Tank Co.
St. Regis Paper Co.
United States Stoneware Co.

CONTROLLERS

American Instrument Co. (temperature and humidity)
Burling Instrument Co. (temperature)
Thomas A. Edison, Inc., Instrument Div. (electric thermostats, time delaying relays, self operated thermostatic steam valves)
Charles Engelhard, Inc. (temperature)
Fischer & Porter Co. (flow-liquid, gas, vapor, electric & air operated)
General Electric Co. (electric)
Illinois Testing Laboratories, Inc. (temperature)
Industrial Instruments, Inc. (solution concentration by conductivity)
National Technical Laboratories, Ph
Paper & Industrial Appliances, Inc. (consistency)
Reeves Pulley Co. (speed)
Sarco Co., Inc. (temperature)
Selas Co. (combustion)
Wallace & Tie nan Co., Inc. (chlorine control apparatus)
Westinghouse Electric & Mfg. Co. (electric)

CONVEYING MACHINERY & EQUIPMENT

A-1 Bottling Machinery Co.
American Engineering Co. (electric hoists)
C. O. Bartlett & Snow Co.
Fuller Co.
Great Western Mfg. Co.
Gruendler Crusher & Pulv. Co.
Gump, B. F.
Horix Mfg. Co.
Ironbound Box & Lumber Co. (platforms, pallets)
Jeffrey Mfg. Co. (chains and sprockets, conveyors, apron-belt, drag, pan-pivoted bucket, portable, scraper, spiral, vibrating)
Karl Kiefer Machine Co. (for bottles, tubes, jars, tins
Lamson Corp. (package handling, gravity, belt, apron, spiral chutes, overhead, Trayveyors)
Geo. C. Lever Co. (casters, conveyors, belt, gravity portable, mono-rail trolley, trucks, wheels, electric hoists, loaders, portable platforms, lifts, pallets)
Link-Belt Co.
Magnetic Engrg. & Mfg. Co.
National Engineering Co.
Nutting Truck & Caster Co. (truck casters, lift truck platforms, trucks, hand & industrial, wheels, trucks-rubber tired)
Rapids-Standard Co. (casters, two and four wheel floor trucks, gravity wheel conveyors, power belt conveyors, plastic wheels for casters & floor trucks)
Reeves Pulley Co.
Robinson Mfg. Co.
Sprout-Waldron & Co.
Stephens-Adamson Mfg. Co.
Syntron Co.

COOLERS

American Smelting & Refining Co.
C. O. Bartlett & Snow Co.
S. Blickman, Inc. (stainless steel)
Corning Glass Works
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
Fuller Co.
General Ceramics Co.
Hardinge Co., Inc.
Hersey Mfg. Co.
Jeffrey Mfg. Co.
L. O. Koven & Bro., Inc.
Link-Belt Co.
Louisville Drying Machinery Co.
National Carbon Co. (Karbate)
Patterson-Kelley Co., Inc.
F. J. Stokes Machine Co. (rotary drum)
United States Stoneware Co.
Westinghouse Electric & Mfg. Co. (water, drinking)

COOLING PONDS

Air & Refrigeration Corp.

COOPERAGE

Associated Cooperage Industries of America, Inc. (wooden barrels and kegs, tight and slack)

COUPLINGS

Great Western Mfg. Co.
Jeffrey Mfg. Co.
Kinney Mfg. Co. (cut-off)
Koppers Co.
Link-Belt Co. (shaft, flexible & rigid)
Luzerne Rubber Co. (hard rubber)
Packless Metal Products Corp. (detachable)
Parker Appliance Co.
Syntron Co. (swivel pipe)
Walworth Co.

CRANES

Barrett-Cravens Co.
Lewis Shepard Sales Corp.
Revolvator Co.

CRUCIBLES

Baker & Co., Inc. (platinum)
Carborundum Co.
Corning Glass Works.
Eimer & Amend
National Carbon Co. (carbon & graphite)
Selas Co.

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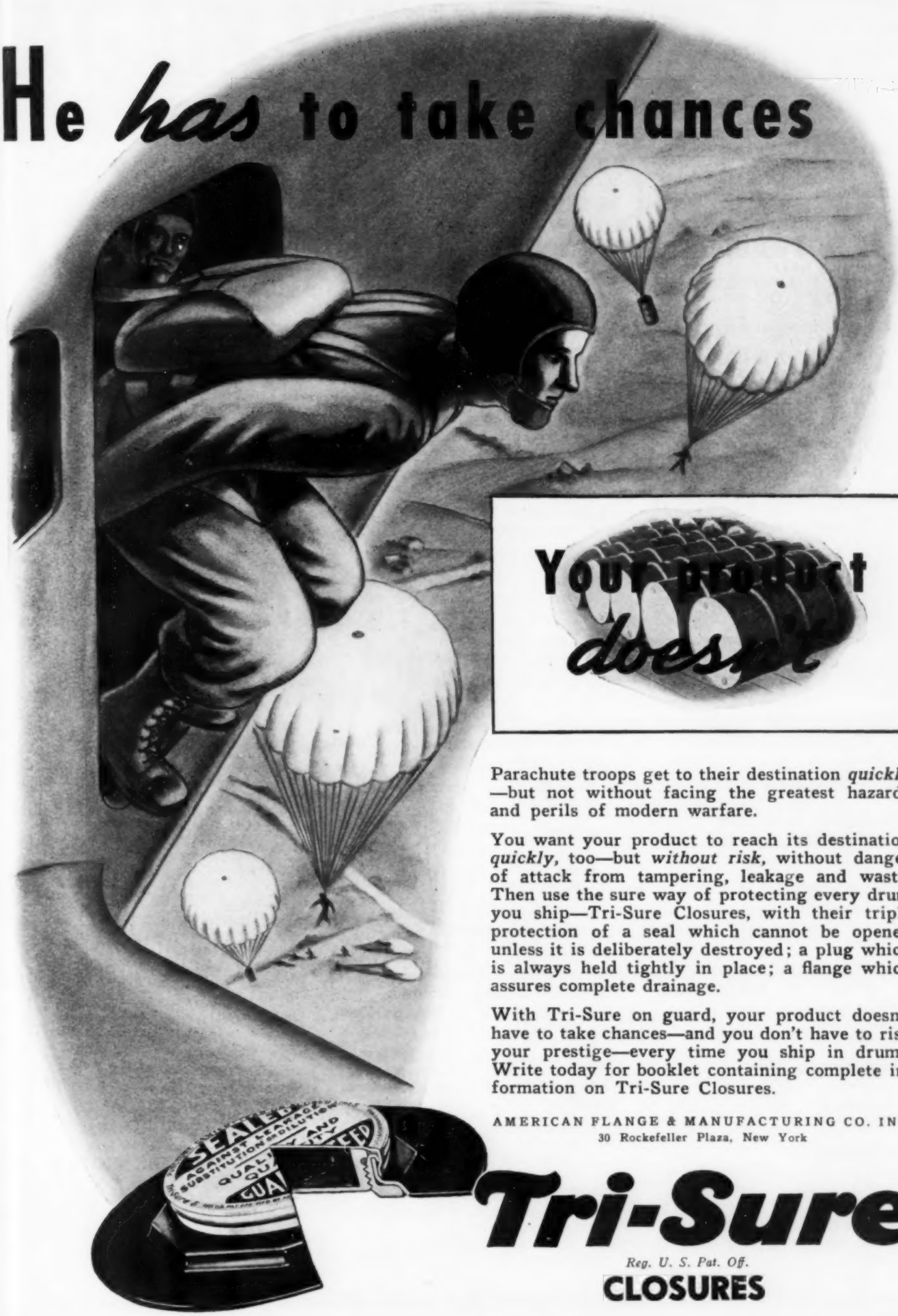
He *has* to take chances



Parachute troops get to their destination *quickly* —but not without facing the greatest hazards and perils of modern warfare.

You want your product to reach its destination *quickly*, too—but *without risk*, without danger of attack from tampering, leakage and waste. Then use the sure way of protecting every drum you ship—Tri-Sure Closures, with their triple protection of a seal which cannot be opened unless it is deliberately destroyed; a plug which is always held tightly in place; a flange which assures complete drainage.

With Tri-Sure on guard, your product doesn't have to take chances—and you don't have to risk your prestige—every time you ship in drums. Write today for booklet containing complete information on Tri-Sure Closures.

AMERICAN FLANGE & MANUFACTURING CO. INC.
30 Rockefeller Plaza, New York

Tri-Sure

Reg. U. S. Pat. Off.

CLOSURES

Titanium Alloy Mfg. Co.

CRUSHERS, GRINDING MILLS & PULVERIZERS

Abbe Engineering Co.
C. O. Bartlett & Snow Co.
Blaw-Knox Co. (proportioning)
Denver Equip. Co.
Gruendler Crusher & Pulv. Co.
Hardinge Co., Inc.
Jay-Bee Sales Co.
Jeffrey Mfg. Co. (sewage screenings and green garbage)
Kent Machine Works, Inc. (paint & printing inks)
Lancaster Iron Works, Inc.
Link-Belt Co. (coal, coke, ice)
National Engineering Co.
Paper & Industrial Appliances, Inc. (defibrators)
Patterson-Kelley Co., Inc.
Pulverizing Machinery Co.
Raymond Pulverizer Div. Combustion Engineering Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
United States Stoneware Co.
Williams Patent Crusher & Pulverizer Co.

CRYSTALLIZING EQUIPMENT

S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
L. O. Koven & Bro., Inc
Pfaudler Co.
Robinson Mfg. Co.
Sowers Mfg. Co.
United States Stoneware Co.

CUTTERS

Robinson Mfg. Co. (knife)

CYLINDERS FOR HIGH PRESSURE GASES

Matheson Co., Inc.
Ohio Chemical & Mfg. Co.
Pressed Steel Tank Co.

CYLINDERS FOR LOW PRESSURE GASES

Pressed Steel Tank Co.

CO_2 RECORDERS

Cambridge Instrument Co.
Charles Engelhard, Inc. (portable indicator)

DECOLORIZATION AND PURIFYING MATERIALS

Atlas Powder Co.
Darco Corp.
Dicalite Co.

DETERGENTS

Atlas Powder Co.
Darco Corp.
Quigley Co., Inc.

DIAPHRAGMS

General Ceramics Co. (electrolytic)
Norton Co. (electrolytic)

DIFFUSERS

Carborundum Co.
Selas Co.

DIGESTERS

Blaw-Knox Co.
Dorr Co., Inc.
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
General Ceramics Co.
Hardinge Co., Inc.
L. O. Koven & Bro. Inc.
Lancaster Iron Works, Inc.
National Carbon Co.
Paper & Industrial Appliances, Inc. (continuous-cookers)
Patterson-Kelley Co., Inc.
Pfaudler Co.
Sowers Mfg. Co.

DISSOLVERS

Abbe Engineering Co.
Baker Perkins, Inc.
Dorr Co., Inc.
Dover Boiler & Plate Fabricators, Inc.
General Ceramics Co.
L. O. Koven & Bro., Inc.
New England Tank & Tower Co.
Patterson-Kelley Co., Inc.
Robinson Mfg. Co.
Sowers Mfg. Co.

DISTILLING MACHINERY AND APPARATUS

Aluminum Co. of America
Blaw-Knox Co.
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
Eclipse Fuel Engineering Co.
Eimer & Amend
Ertel Engineering Corp.
General Ceramics Co.
Great Western Mfg. Co.
Henry E. Jacoby
King Refrigeration Co.
L. O. Koven & Bro., Inc.
Patterson-Kelley Co., Inc.
Pfaudler Co.
Robinson Mfg. Co.
Scientific Glass Apparatus Co.
Sowers Mfg. Co.

DRIVES

General Electric Co.
Great Western Mfg. Co.
Link-Belt Co.
New England Tank & Tower Co.
Reeves Pulley Co.
Stephens-Adamson Mfg. Co.
Westinghouse Electric & Mfg. Co. (electric)

DRUMS—Rotary—Vacuum

American Flange & Mfg. Co., Inc. (fittings)
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
L. O. Koven & Bro., Inc.
Magnetic Engrg. & Mfg. Co. (magnetic)
Robinson Mfg. Co.

DRYERS—Centrifugal

American Machine & Metals, Inc.
Baker Perkins, Inc.
Bird Machine Co.
Blaw-Knox Co.
Buffalo Foundry & Machine Co.
Fletcher Works, Inc.
W. A. Hammond Drierite Co.
Link-Belt Co. (roto & louvre)
Sharples Corp.

DRYING AGENTS

W. A. Hammond Drierite Co. (for solids, liquids, gases, in institutions, industries, laboratories, plants-adsorbents, desiccants, desiccators)

DRYING MACHINERY AND EQUIPMENT

Air & Refrigeration Corp.
Aluminum Co. of America
Baker Perkins, Inc. (vacuum mixers)
C. O. Bartlett & Snow Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel atmospheric, vacuum, rotary)
Buffalo Foundry & Machine Co.
Great Western Mfg. Co.
Gump, B. F.
W. A. Hammond Drierite Co.
Hardinge Co., Inc.
Hersey Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Louisville Drying Mchy. Co.
Pfaudler Co.
Procter & Schwartz, Inc.
Reeves Pulley Co.
Robinson Mfg. Co.
Selas Co.
Sowers Mfg. Co.
F. J. Stokes Machine Co.
Vitreo Sales Corp. (enameled steel drying trays)

DUST COLLECTING SYSTEMS

American Air Filter Co., Inc.
American Foundry Equipment Co.
C. O. Bartlett & Snow Co.
Federal Classifier Systems, Inc.
Great Western Mfg. Co.
Pangborn Corp.
Richmond Mfg. Co.
Robinson Mfg. Co.
Claude B. Schneible Co.
Westinghouse Electric & Mfg. Co.
Williams Patent Crusher & Pulverizer Co.

DUST AND SPRAY MASKS

Mine Safety Appliances Co.
Pangborn Corp.
Willson Products, Inc.

DYEING EQUIPMENT

S. Blickman, Inc. (dye boxes, stainless steel)

EJECTORS

General Ceramics Co.
Luzerne Rubber Co. (hard rubber)
Nash Engineering Co. (sewage)
United States Stoneware Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC HEATING UNITS & EQUIPMENT

Edwin L. Wiegand Co.

ELECTRICAL SUPPLIES

General Electric Co.

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AGAIN IT'S *Beckman*

with another important — *and exclusive* — pH development...

AUTOMATIC
MULTIPLE GLASS ELECTRODE
RECORDING!

Again another major advancement in the pH field is developed by Beckman—*and available exclusively with Beckman pH Equipment*...the *Automatic Multiple Glass Electrode Recording Switch!*

WHAT IT DOES: This switch makes possible *automatic and continuous* pH recording from as many as SIX different electrode stations, using only *one* Beckman pH Indicator and *one* multiple recording instrument. Thus, from a single indicator and recorder installation, you can maintain automatic and continuous check over the pH in as many as *six* different operations of your plant processes.

HOW IT WORKS: The switch is completely automatic in operation and there's nothing to require the operator's attention at any time. *Automatically* the switch connects the first set of electrodes into the automatic pH indicator and gives time for the recorder to print the pH reading from this set of electrodes on the chart. Then the switch automatically disconnects the first station and connects in the next electrode station for recording its pH reading ...repeating this operation on as many as six electrode stations, and then repeating the cycle over again, *continuously*, without any attention from the operator.

The Automatic Multi-Electrode Switch is another Beckman pH development of major importance to modern industrial control operations. Like the *Beckman High pH Electrode*, the *Beckman High Temperature Electrode* and other Beckman advancements, this new pH development is available in Beckman Equipment *exclusively!*

Now, more than ever, Beckman is the ONLY make of pH equipment incorporating ALL the modern pH advancements!

***LET OUR TRAINED RESEARCH STAFF HELP YOU* adapt Beckman pH Control to speed up production, reduce waste and increase plant efficiency in YOUR operations!**

WORLD'S LARGEST MANUFACTURER OF GLASS ELECTRODE *pH* EQUIPMENT

Beckman **The leading name in pH**

NATIONAL TECHNICAL LABORATORIES • SOUTH PASADENA, CALIF.

SEE BECKMAN pH EQUIPMENT AT THE CHEMICAL EXPOSITION—BOOTHS 300-301

Synthane Corp.
United States Steel Corp. (wire and cable)
Westinghouse Electric & Mfg. Co.

ELECTROSTATIC SEPARATORS

Separations Engineering Co.
Sutton, Steele & Steele, Inc.

ELECTROPLATING SALTS

Baker & Co., Inc. (gold, rhodium solutions, platinum)

ELEVATORS

Barrett Cravens Co.
C. O. Bartlett & Snow Co.
Economy Engineering Co. (portable)
General Ceramics Co.
Great Western Mfg. Co.
Gruendler Crusher & Pulv. Co.
Gump, B. F.
Jeffrey Mfg. Co.
Lewis-Shepard Sales Corp. (portable)
Link-Belt Co. (chain, belt, bucket, portable)
Revolvator Co.
Richmond Mfg. Co. (employees)
Robinson Mfg. Co.
Sprout, Waldron & Co.
Westinghouse Electric & Mfg. Co.

EMULSIFIERS

Abbe Engineering Co.
Alsop Engineering Corp.
Atlas Powder Co.
Chemicolloid Laboratories, Inc.
Commercial Solvents Corp.
Darco Corp.
Eppenbach, Inc.
Glyco Products Co., Inc.
Hendrick Mfg. Co.
Pfaudler Co.
Premier Mill Corp.
Robinson Mfg. Co.
Selas Co.
Sowers Mfg. Co.

ENAMELED APPARATUS

Ertel Engineering Corp. (tanks)
Henry E. Jacoby (filter plates)
Pfaudler Co. (glass)
Vitreo Sales Corp. (enameled steel drying trays)

ENAMELS

Atlas Powder Co.
Darco Corp.
Quigley Co., Inc.

ENGINEERS

C. O. Bartlett & Snow Co.
Blaw-Knox Co.
Buffalo Foundry & Machine Co.
General Ceramics Co.
Goslin-Birmingham Mfg. Co.
National Engineering Co.
Patterson-Kelley Co., Inc.
Selas Co.
E. H. Sheldon & Co.
Foster D. Snell, Inc.

EVAPORATORS

Aluminum Co. of America
American Smelting & Refining Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabrs., Inc.
Fansteel Metallurgical Corp.
General Ceramics Co.
Goslin-Birmingham Mfg. Co.
Henry E. Jacoby
L. O. Koven & Bro., Inc.
Louisville Drying Mchy. Co.
National Carbon Co. (graphite)
Patterson-Kelley Co., Inc.
F. J. Stokes Machine Co.

EXHAUSTERS

American Foundry Equipment Co.
General Ceramics Co.
Laboratory Furniture Co. (laboratory)
Schutte & Koerting Co.
United States Stoneware Co.

EXPLOSIVES

Atlas Powder Co.
Darco Corp.
Hercules Powder Co.

EXTRACTION PLANTS

Blaw-Knox Co.
General Ceramics Co.
Pfaudler Co.
F. J. Stokes Machine Co.

FEEDERS

C. O. Bartlett & Snow Co.
Denver Equip. Co.
Federal Classifier Systems, Inc.
Fuller Co.
Graver Tank & Mfg. Co., Inc.
Gruendler Crusher & Pulv. Co.
Gump, B. F.
Hardinge Co., Inc.
Hills-McCanna Co. (chemical)
Jeffrey Mfg. Co. (apron-belt, vibrating, Waytrol-plate)
Lancaster Iron Works, Inc.
Link-Belt Co. (belt, apron, reciprocating, grizzly)
Robinson Mfg. Co.
Milton Roy Pumps
Syntron Co. (constant weigh)

FILLERS

Dicalite Co. (asphalt, mineral, paint, enamel, varnish, lacquer, papermakers, plastic, rubber, polish)

FILLING MACHINES

Alsop Engineering Corp.
Elgin Mfg. Co.
Ertel Engineering Corp.
Gump, B. F.
Horix Mfg. Co.
Karl Kiefer Machine Co. (automatic & semi-automatic, hand fed, for bottles, jars, tins, collapsible tubes.
PerfeKtum Products Co. (ampoule)
Pfaudler Co.
Pneumatic Scale Corp. Ltd.
Stokes & Smith Co.
St. Regis Paper Co.
Aurelio Tanzi Engrg. Co.
Triangle Package Mchy. Co.

FILTER AIDS

Alsop Engineering Corp.
American Seitz Filter Corp.
Atlas Powder Co.
Darco Corp.
Dicalite Co.
Ertel Engineering Corp.
Johns-Manville
Paramount Rubber Co. (filtomesh)
Protective Coatings, Inc. (filtomesh)

FILTER CLOTH

American Seitz Filter Corp.
Ertel Engineering Corp.
Henry E. Jacoby
Owens-Corning Fiberglas Corp.
Richmond Mfg. Co.
John A. Roebling's Sons Co.
T. Shriver & Co.
W. S. Tyler Co.

FILTER CLOTH—Metallic

Henry E. Jacoby
Newark Wire Cloth Co.
Oliver United Filters, Inc.

FILTER PAPER

Alsop Engineering Corp.
American Seitz Filter Corp.
Eimer & Amend
Ertel Engineering Corp.
Henry E. Jacoby
Sparkler Mfg. Co.

FILTERING MATERIAL

Graver Tank & Mfg. Co. (sand, gravel, quartz, silica, carbonaceous, activated carbon)

FILTERS

Air & Refrigeration Corp. (air)
Alsop Engineering Corp. (liquid)
American Air Filter Co. (air)
American Seitz Filter Corp. (liquid)
Bird Machine Co. (centrifugal)
Black, Sivalls & Bryson, Inc. (refin-oil)
S. Blickman, Inc. (stainless steel vacuum & pressure)
Carborundum Co. (ceramic)
Corning Glass Works (fritted glass, color)
Denver Equip Co. (continuous, rotary)
Dover Boiler & Plate Fabricators, Inc.
Ertel Engineering Corp. (all types)
Federal Classifier Systems, Inc.
Filtration Engineers, Inc. (continuous rotary vacuum)
Fischer & Porter Co. (gasoline and light oil)
General Ceramics Co. (chemical stoneware)
Goslin-Birmingham Mfg. Co. (Vallez rotary heat pressure, rotary drum vacuum, continuous pressure heat, Conkey Sludge, rotary hopper vacuum dewaterer)
Graver Tank & Mfg. Co., Inc. (water)
Henry E. Jacoby (plate and frame)
Karl Kiefer Machine Co.
Maurice A. Knight
L. O. Koven & Bro., Inc.
Lapp Insulator Co. (vacuum, porcelain)
Magnetic Engrg. & Mfg. Co. (magnetic)
National Carbon Co. (porous carbon and graphite)
Newark Wire Cloth Co.
Norton Co. (fused alumina)
Oliver United Filters, Inc. (continuous vacuum and pressure, pressure, pre-coat, Hoppeu dewaterers)
Reineveld Corp. (centrifugal)
Selas Co. (ceramic)
T. Shriver & Co. (presses)
Sparkler Mfg. Co. (horizontal, plate, industrial pressure and laboratory, household water, comm. water)

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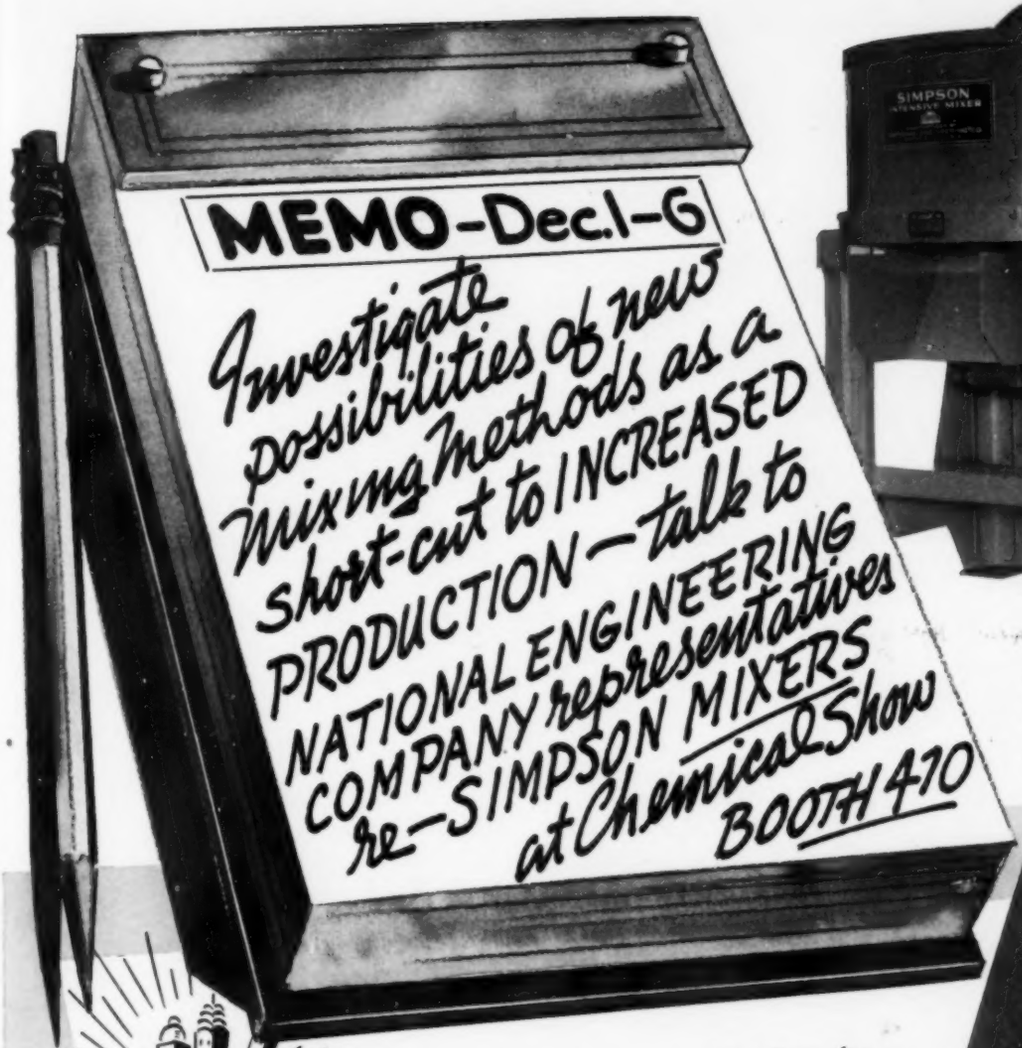
MEMO-Dec.1-G
Investigate possibilities of new mixing methods as a short-cut to INCREASED PRODUCTION—talk to NATIONAL ENGINEERING COMPANY representatives re—SIMPSON MIXERS at Chemical Show BOOTH 470

• *Illustrated here is the new 5 ft. dia. pan Simpson Intensive Mixer, which makes available a capacity of 8 to 10 cubic feet.*

WE sincerely hope that you will follow the suggested memorandum shown above while attending the 1941 Chemical Exposition. Perhaps our engineers can help you in solving specific mixing problems, or in suggesting a new mixing procedure to replace slower, inefficient methods now in use.

Simpson Intensive Mixers are now being built in 10 sizes, to meet practically any mixing requirement in the chemical and process industries. Are you taking advantage of the benefits these modern mulling units offer? Come in and discuss your problems with us — *make Booth 470 a "must" call at the Show.*

HAVE YOU RECEIVED YOUR NEW CATALOG?

If you have not already sent for your copy of the new 36-page Simpson Intensive Mixer Catalog, ask for it at Booth 470. — It's free to executives and engineers.

SIMPSON INTENSIVE MIXERS

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING • CHICAGO, ILLINOIS

Manufacturers and Selling Agents for Continental European Countries:—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

F. J. Stokes Machine Co. (rotary drum flakers)
United States Stoneware Co. (vacuum)

FIRE CLAY

Quigley Co., Inc.
United States Stoneware Co.

FIRE DETECTION

Thomas A. Edison, Inc., Instrument Div. (automatic fire detector)
Walter Kidde & Co., Inc.

FIRE EXTINGUISHERS

Blaw-Knox Co. (automatic sprinkler system)
Grinnell Co., Inc.
Walter Kidde & Co., Inc.

FIRE PREVENTION

Blaw-Knox Co. (automatic sprinkler systems)
Grinnell Co., Inc. (automatic sprinkler systems)
Walter Kidde & Co., Inc.

FIREPROOFING COMPOUNDS

American Resinous Products Co.
Bay State Chemical Co.
Glyco Products Co., Inc.
Johns-Manville.

FITTINGS

Aluminum Co. of America
American Flange & Mfg. Co., Inc. (steel drum)
American Hard Rubber Co.
Bump Pump Co.
General Ceramics Co.
Grinnell Co., Inc.
International Nickel Co.
National Carbon Co. (carbon, graphite, Karbate)
Packless Metal Products Corp.
Parker Appliance Co.
Tri-Clover Machine Co. (stainless steel)
United States Stoneware Co.
Walworth Co. (pipe, all kinds)

FLANGES

American Flange & Mfg. Co. (steel drum)

FLOORING

Electro Chemical Supply & Engrg. Co. (acid proof)
General Ceramics Co.
Hendrick Mfg. Co.
Paramount Rubber Co. (marblon)
Protective Coatings, Inc. (marblon)
United States Steel Corp. (steel)
United States Stoneware Co.

FLOOR MACHINES

Kent Co., Inc. (electric moppers, cleaners, vacuum cleaners- comm.)

FOOD INDUSTRIES EQUIPMENT

Aluminum Co. of America
American Instrument Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel cookers, kettles, tanks, evaporators, blenders, pans, trucks)
Brabender Corp.
Dover Boiler & Plate Fabricators, Inc.
Duriron Co., Inc.
Economic Machinery Co.
Gump, B. F.
Horix Mfg. Co.
Jeffrey Mfg. Co.
Karl Kiefer Machine Co.
L. O. Koven & Bro., Inc.
Lee Metal Products Co., Inc. (kettles, tanks, stainless steel, nickel and monel)
Luzerne Rubber Co. (hard rubber refrigeration)
Magnetic Engrg. & Mfg. Co.
Marlo Co.
National Engineering Co.
New Jersey Machine Co.
Pfaudler Co.
Pneumatic Scale Corp., Ltd. (bag packers, weighers, cartoning, wrapping)
Premier Mill Corp.
Productive Equipment Co.
Pulverizing Machinery Co.
Read Machinery Co., Inc.
Richmond Mfg. Co.
Robinson Mfg. Co.
Sharples Corp.
E. H. Sheldon & Co. (laboratory)
Sprout, Waldron & Co.
Stephens-Adamson Mfg. Co.
Stokes & Smith Co.
United States Stoneware Co.

FURNACES & ACCESSORIES

Baker & Co., Inc. (blowerless gas furnaces for heat treating and brazing- precious metal thermocouples)
Carborundum Co. (globar heating elements)
Eclipse Fuel Engineering Co. (heat treating)
Eimer & Amend (laboratory)
Electro Chemical Supply & Engrg. Co. (acid manufacture)
Fischer & Porter Co. (gas and oil flow regulators, controllers, indicators)
General Alloys Co. (parts and fixtures for industrial furnaces)
General Electric Co. (electric)
Kent Co., Inc. (cleaners, vacuum for)
Reeves Pulley Co.
Selas Co. (process, gas fired)
Westinghouse Electric & Mfg. Co. (electric)

GASKETS

American Flange & Mfg. Co. (drum plug)

GEARS

Cleveland Worm & Gear Co. (worm)
Great Western Mfg. Co.
Jeffrey Mfg. Co.
Philadelphia Gear Works
Westinghouse Electric & Mfg. Co.

GLASS—Optical

Fischer & Porter Co. (precision ground)
E. W. Pike & Co. (lenses, magnifiers)

GLASSWARE

Corning Glass Works (industrial & laboratory, 96% silica)
Eimer & Amend
Fischer & Porter Co. (precision laboratory apparatus, precision bore tubing, Hoeppler Viscosimeter tubes, absorption and colorimeter, precision square tubing)
Hanovia Chemical & Mfg. Co.
Kimble Glass Co. (laboratory)
Scientific Glass Apparatus Co. (inter joints, glas-col heaters for flasks)

GRATING

Aluminum Co. of America
Blaw-Knox Co.
Hendrick Mfg. Co.

GAGES

American Instrument Co. (coating thickness on metals, high pressure)
American Meter Co. (Volume and Pressure "U")
Corning Glass Works (mamometer & flowmeter)
Fischer & Porter Co. (tailboxes)
General Electric Co. (electric)
Hoke, Inc. (pressure)
Matheson Co., Inc. (for compressed gases)
Meriam Co. (mercury pressure, tank liquid level)
F. J. Stokes Machine Co. (vacuum)

GAS BOOSTERS

Beach-Russ Co.

GAS COMBUSTION EQUIPMENT

Selas Co.

GAS PRODUCERS

Koppers Co.

GAS PURIFIERS

Blaw-Knox Co.
Dover Boiler & Plate Fabricators, Inc.
Koppers Co.
L. O. Koven & Bro., Inc.
Claude B. Schneible Co. (fume absorption equipment)

GASES

W. A. Hammond Drierite Co.
Matheson Co., Inc. (laboratory)
Ohio Chemical & Mfg. Co.

HEAT EXCHANGERS

Aluminum Co. of America
Baker & Co., Inc. (platinum clad, all types)
Black, Sivalls & Bryson, Inc.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
E. G. Budd Mfg. Co.
Buffalo Foundry & Machine Co.
Corning Glass Works (glass)
Duriron Co., Inc.
Fansteel Metallurgical Corp.
General Ceramics Co.
Goslin-Birmingham Mfg. Co.
Graver Tank & Mfg. Co., Inc.
Henry E. Jacoby
Jeffrey Mfg. Co.
Koppers Co.
National Carbon Co. (Karbate)
Patterson-Kelley Co., Inc.
Westinghouse Electric & Mfg. Co.
York Ice Mchy. Corp.

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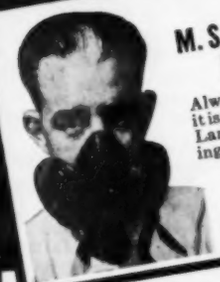
MORE MEN AT WORK... MORE NEED FOR M·S·A

DUST and FUME PROTECTION



M. S. A. Comfo DUST and MIST RESPIRATOR

Always a leader in popularity because it is so efficient, sturdy, and fool-proof. Large twin filters assure low breathing resistance. Approved by U. S. Bureau of Mines for pneumoconiosis-producing nuisance and toxic dusts. Bulletin CR-3.

M. S. A. CHEMICAL CARTRIDGE RESPIRATOR

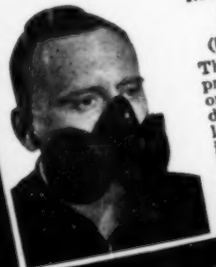
Provides efficient and comfortable protection against harmful or irritating gases and vapors in light concentrations as encountered in paint spraying and other industrial processes. Twin cartridges are easily replaced and provide more than twice the service life of single cartridge types. Bulletin EM-3.

THE DUSTFOE RESPIRATOR

Weighs only 3¼ ounces, remarkably compact; deep facepiece snugly fits facial contours—soft sponge rubber face cushion, U. S. Army gas mask type exhalation valve—U. S. Bureau of Mines-approved for ALL dusts. Bulletin CM-5.

M. S. A. ABRASIVE MASK

Safe, comfortable, durable protection for shot or sandblast operators. Weighing less than 4 lbs., this Mask shows remarkable endurance against abrasive wear, has gas-mask type facepiece under lightweight hood, connecting tube with "bump-proof" flow control valve, quick release connection, belt and optional air filter. U. S. Bureau of Mines-approved. Bulletin No. CS-3.



M. S. A. Comfo METAL FUME RESPIRATOR

(U. S. Bureau of Mines-approved)

This M.S.A. product offers safe protection against fumes from heated or molten metal, and in particular is designed to protect the wearer from lead fumes encountered in lead burning, welding, etc. The M.S.A. Metal Fume Respirator is compact, snug-fitting, and affords outstanding wearing ease. No interference with any head covering. Bulletin CR-7.

M. S. A. AIR LINE RESPIRATOR

Supplies air to wearer completely independent of working atmosphere. Recommended where worker is exposed to variety or mixture of dust, gases and fumes. Navy half-mask facepiece attached to flexible corrugated tube with air control valve at belt. U. S. Bureau of Mines-approved. Bulletin CS-7.

With peak production pressing hard on your plant facilities, make sure that your respiratory safety equipment meets the requirements of increased personnel!

Consider your needs for more extended dust and fume protection, and then check into the complete range of respiratory protection offered by M.S.A. You'll find a properly designed and engineered product for every hazardous job in your operations—and a simple request will bring a trained M.S.A. field representative with the items in which you are interested, ready to give you actual demonstrations *on-the-job*. Meanwhile—write for our descriptive bulletins!

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS, PITTSBURGH, PA.

DISTRICT REPRESENTATIVES IN PRINCIPAL CITIES

HEATERS
Graver Tank & Mfg. Co., Inc. (water)
Edwin L. Wiegand Co. (electric)

HEAT TREATING
General Alloys Co. (cyanide and lead pots, chain, acid and heat resistant, carburizing boxes)

HEATING SYSTEMS AND ACCESSORIES
Air & Refrigeration Corp.
Eclipse Fuel Engineering Co.
General Electric Co.
Grinnell Co., Inc.
Jeffrey Mfg. Co.
Nash Engineering Co.
Sarco Co., Inc.
Selas Co.

HEATING UNITS & EQUIPMENT
Edwin L. Wiegand Co. (electric)

HOISTS
Barrett-Cravens Co.
C. O. Bartlett & Snow Co.
Philadelphia Gear Works
Revolvator Co.
Yale & Towne Mfg. Co.

HOMOGENIZERS
C. O. Bartlett & Snow Co.
Chemicolloid Laboratories, Inc.
Eppenbach, Inc.
Hendrick Mfg. Co.
Patterson-Kelley Co., Inc.
Robinson Mfg. Co.

HOODS—Fume
Alberene Stone Corp. of Va.
American Hard Rubber Co.
S. Blickman, Inc. (stainless steel)
E. G. Budd Mfg. Co.
General Ceramics Co.
Leonard Peterson & Co., Inc.
E. H. Sheldon & Co.

HOSE
Packless Metal Products Corp. (flexible bronze, seamless, connectors, flexible exhaust lines)

HUMIDIFYING APPARATUS
Air & Refrigeration Corp.

HYDROGEN ION
American Instrument Co.
Cambridge Instrument Co.
Coleman Electric Co., Inc.
National Technical Laboratories
PerfeKtum Products Co.
Scientific Glass Apparatus Co.
W. A. Taylor & Co.

INDICATORS
Cambridge Instrument Co. (moisture)
Thomas A. Edison, Inc. Instrument Div. (aircraft, pressure and temperature)
Charles Engelhard, Inc. (portable CO_2)
Fischer & Porter Co. (bulls eye sight flow, continuous specific gravity)
Fuller Co. (bulk, material, level)
General Electric Co.
Meriam Co. (flow, pressure, vacuum, differential, rate and flow)
National Technical Laboratories (pH)
Schutte & Koerting Co. (flow)
Stephens-Adamson Mfg. Co.

INSTRUMENTS—Optical
American Instrument Co.
Fischer & Porter Co. (precision absorption, colorimeters and other cells
National Technical Laboratories
Scientific Glass Apparatus Co. (spectrochemical)
Willson Products, Inc.

INSTRUMENTS—Testing
American Instrument Co. (scientific, materials texting, X-Ray)
Brabender Corp.
Cambridge Instrument Co. (gas analysis, permeameter, voltamograph)
Coleman Electric Co., Inc. (fluorimeters, spectrophotometers)
Charles Engelhard, Inc. (exhaust gas analyzer, thermocouples, rare and base metals)
Federal Classifier Systems, Inc.
Fischer & Porter Co. (rotometer, instantaneous rate of flow meter, specific gravity apparatus, continuous indicator)
General Electric Co.
Great Western Mfg. Co.
Industrial Instruments, Inc. (megohmeters, conductivity & resistance bridges)
King Refrigeration Co.
Meriam Co. (flow meters, manometers, mercury pressure gauges, tank gauges)
National Technical Laboratories (spectrophotometers, photostats, Titration apparatus, electrodes, glass and metallic)
Paper and Industrial Appliances, Inc. (Freeness)
Photovolt Corp.
Reeves Pulley Co.
Scientific Glass Apparatus Co. (spectrochemical, glas-col heaters for flasks)
W. A. Taylor & Co. (boiler water comparators, chlorine control, water analysis)
Toledo Scale Co.
Westinghouse Electric & Mfg. Co.
Willson Products, Inc. (air analysis)

INSULATION MATERIAL—Heating, Electric and Molded
Aluminum Co. of America
Johns-Manville
Luzerne Rubber Co. (hard rubber)
Quigley Co., Inc.
Synthane Corp.
Titanium Alloy Mfg. Co.
Westinghouse Electric & Mfg. Co.

INSULATION—Furnace
Aluminum Co. of America
Carborundum Co.
Dicalite Co.
Owens-Corning Fibreglas Corp.
Quigley Co., Inc.

JOINTS
Barco Mfg. Co. (ball, swivel, revolving, aircraft)
Walworth Co. (pipe)

KETTLES
Aluminum Co. of America (steam jacket)
American Smelting & Refining Co. (lead)
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel, corrosion resisting, acid proof, confectionary, steam jacketed, dye and color, mixing, paint and varnish, process, vacuum)
Buffalo Foundry & Machine Co. (process and reaction)
Dover Boiler & Plate Fabricators, Inc. (all)
Duriron Co., Inc. (Duriron, Durichlor)
General Ceramics Co. (chemical stoneware)
Hendrick Mfg. Co. (mixing, resin)
Henry E. Jacoby (non ferrous)
Maurice A. Knight
L. O. Koven & Bro., Inc.
Lapp Insulator Co. (porcelain)
Lee Metal Products Co., Inc. (stainless steel, nickel, monel, steam and water jacketed and plain, all sizes from five to five hundred gallon, working pressures to 125 lb. per sq. inch—stationary and tilting—with agitators & motors)
New England Tank & Tower Co.
Patterson-Kelley Co., Inc. (jacketed and plain, any metal, Code, Non-Code—with or without mixers)
Pfaudler Co. (glass lined and stainless)
Robinson Mfg. Co. (mixing)
Selas Co. (varnish and kettle settings)
Sowers Mfg. Co. (cast)
United States Stoneware Co. (acid)

KILNS
C. O. Bartlett & Snow Co. (rotary)
Hardinge Co., Inc. (rotary)
Selas Co. (ceramic)

LABELING MACHINES
Alsop Engineering Corp.
Diagraph-Bradley Stencil Machine Corp. (stencil board paper, stencil machines, label pasters, shipping room supplies, stencil ink)
Economic Machinery Co.
Edward Ermold Co.
Geo. C. Lever Co. (stencil machines, stencil board paper, ink)
New Jersey Machine Co.
PerfeKtum Products Co. (ampoule)
Pneumatic Scale Corp., Ltd.
Tripard Mfg. Co., Inc. (stencil cutting, stencil brushes, inks, papers, stencil machines)

LABORATORIES—Testing
Denver Equip. Co.
Dorr Co., Inc.
Great Western Mfg. Co.
Federal Classifier Systems, Inc.
W. A. Hammond Drierite Co.
Hanovia Chemical & Mfg. Co. (quartz lamps for testing fastness of dyes, paints, surfaces- analyzing, sterilizing of air, liquids, solids, catalysts, Vitamin D activation)

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IRON CONTAMINATION

REMOVED from liquid suspension and free flowing dry materials

FRANTZ FERROFILTER for removing contamination caused by iron and its compounds from **liquid suspension** consists essentially of a stack of unique patented screens. These are strongly magnetized by a surrounding d.c. coil which is electrically insulated from the screens and all other parts of the FerroFilter.

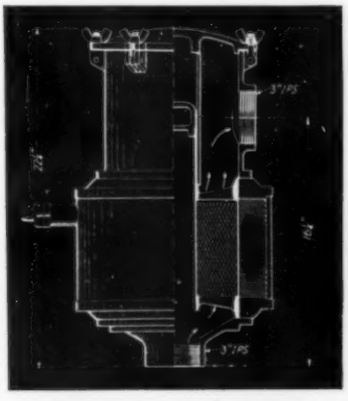
Athough the FerroFilter catches particles **as small as one micron,** the open flow passages allow high capacity in small space, resulting in low-cost treatment. It has no moving parts. Where magnetic particles are to be removed FerroFilters are vastly more efficient than strainer type filters or screens, and much more economical than true filters or centrifugal separators. Hundreds are in use in the process industries.

Available in gravity, underfeed and pipe line types. Wattage requirements show that even the largest unit can be operated for about one cent per hour. Capacities range from 50 to 18,000 gallons per hour depending on size of FerroFilter and viscosity of material.

The new Dry FerroFilter takes iron contamination out of **free flowing dry materials.** It follows the general principles of the screen type wet FerroFilter, but is adapted to free flowing dry granular materials at high capacity.

This model FerroFilter consists of a stack of iron grids strongly magnetized by a direct current coil. There are no moving parts. Material is fed into a hopper at the top and is discharged directly from bottom of FerroFilter.

The grids are made of sloping vanes which divide and retard the flowing stream of material. Alternate grids have vanes sloping in opposite directions: thus the material does not fall through the separator, but moves with an intermittent motion in a zig-zag course so that every particle of material is given a good opportunity to be caught by the sharp magnetized edges of the vanes. Magnetic material is held on these edges until the current is turned off. The size at present available has a capacity of 2 to 10 tons per hour depending on the material.

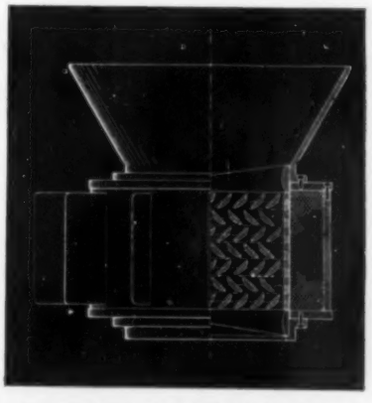


Pipe Line FerroFilter—Entirely Enclosed. Can Be Used Under Vacuum or Pressure.

We also manufacture Frantz Permanent Magnet FerroFilters for lubricating oil, hydraulic and coolant systems. They are self-contained and require no electric power. The stack of screens is energized by two powerful permanent magnets. Capacities range from 300 to 5400 gallons per hour of oil.

At Booth 501 Chemical Show

S. G. FRANTZ CO., INC.
ENGINEERS
163 GRAND STREET, NEW YORK, N. Y.



FerroFilter for Dry Materials—Handles 10 Tons of Dry Sand per Hour.

FRANTZ FERROFILTERS

LABORATORY APPARATUS & SUPPLIES

American Instrument Co. (X-Ray testing)
American Meter Co. (wet and dry test meters, colorimeters, gravitometers, specific gravity apparatus)
American Seitz Filter Corp.
S. Blickman, Inc. (stainless steel process vessels, tanks, condensers, agitators, pans, pilot plants)
Brabender Corp.
Cambridge Instrument Co.
Carborundum Co.
Fred S. Carver
Coleman Electric Co., Inc.
Corning Glass Works (glass)
Denver Equip. Co.
Eastern Engineering Co. (stirrers, variable speed from 1/1000 H.P.)
Eimer & Amend
Charles Engelhard, Inc.
Ertel Engineering Corp.
Federal Classifier Systems, Inc.
Fischer & Porter Co. (see glassware)
General Ceramics Co.
Great Western Mfg. Co.
Hamilton Mfg. Co.
W. A. Hammond Drierite Co.
Hoke, Inc.
Hanovia Chemical & Mfg. Co.
Huber Pump Div. Downingtown Mfg. Co.
Kent Machine Works, Inc.
Kimble Glass Co.
King Refrigeration Co.
National Technical Laboratories
Newark Wire Cloth Co.
Norton Co.
Pfaudler Co.
Photovolt Corp.
Premier Mill Corp.
Richmond Mfg. Co.
Scientific Glass Apparatus Co.
Selas Co.
Aurelio Tanzi Engrg. Co. (mixing of drugs and powders for laboratory and industrial use—dosing machinery, wrapping machine for prescriptions with name or trade mark printed)
United States Stoneware Co.

LABORATORY FURNITURE

Alberene Stone Corp. of Va. (laboratory table tops)
S. Blickman, Inc. stainless steel tables, sinks, drainboards, shelving, etc.)
Eimer & Amend
General Ceramics Co.
Kewaunee Mfg. Co.
Laboratory Furniture Co.
Leonard Peterson & Co., Inc.
E. H. Sheldon & Co.

LAMPS

General Electric Co.
Hanovia Chemical & Mfg. Co. (quartz for testing fastness of paint, dyes-analyzing- sterlizing of air, liquids, solids, catalysts- Vitamin D Activation)

LEAD BURNING AND COATING

American Smelting & Refining Co.
Dover Boiler & Plate Fabricators, Inc.
L. O. Koven & Bro., Inc.
Laboratory Furniture Co.

LIGHTING EQUIPMENT

General Electric Co.
Westinghouse Electric & Mfg. Co.

LININGS

S. Blickman, Inc. (stainless steel, corrosion resisting alloy)

LOADERS

C. O. Bartlett & Snow Co.
Jeffrey Mfg. Co.
Link-Belt Co. (portable, belt, bucket)
National Engineering Co.
Revolvator Co.
Stephens-Adamson Mfg. Co.

LUBRICATORS

Farval Corp. (centralized system)
Hills-McCanna Co. (force feed)

MAGNETIC SEPARATORS

Exolon Co.
S. G. Frantz Co., Inc.
Magnetic Engrg. & Mfg. Co.
Richmond Mfg. Co.
Robinson Mfg. Co.
Separations Engineering Co.

MASTICATORS

Baker Perkins, Inc.
Robinson Mfg. Co.

MATERIALS HANDLING EQUIPMENT

Acme Steel Co. (box strapping, car bracing, machines for strapping, stitching, stapling, staplers, steel hoops, fasteners, steel bands, stitching, stapling wire)
Barrett-Cravens Co. (lift trucks, platforms, barrel and drum trucks, storage racks)
C. O. Bartlett & Snow Co.
S. Blickman, Inc. (stainless steel trucks, portable tubs, racks)
Dorr Co., Inc.
Economy Engineering Co. (barrel lifters, racks for storage of barrels and drums, barrel tilting, stacks)
Elgin Mfg. Co.
Falstrom Co. (drum and barrel)
Fuller Co.
General Ceramics Co.
Great Western Mfg. Co.
Gump, B. F.
Jeffrey Mfg. Co.
Lewis-Shepard Sales Corp. (trucks-lift- floor and hand-skid platforms, stackers, cranes, racks, lifting devices)
Link-Belt Co.
Link-Belt Speeder Corp.
Luzerne Rubber Co. (hard rubber)
Marsh Stencil Machine Co. (stencil machines and equip. of all kinds)
National Box & Lumber Co. (carboy boxes, acid cases, wood spec.)
National Engineering Co.
Productive Equipment Co.
Rapids-Standard Co.
Reeves Pulley Co.
Revolvator Co. (industrial trucks, turntables)
Robinson Mfg. Co.
John A. Roebling's Sons Co. (wire rope and cable)
Read Machinery Co., Inc.
St. Regis Paper Co.
Sprout, Waldron & Co.
Stephens-Adamson Mfg. Co.
Syntron Co. (hydraulic packers and jolters, vibrating packers, hopper level switches)
Tripard Mfg. Co.
Yale & Towne Mfg. Co.

METAL COATING AND PLATING

American Smelting & Refining Co.
Atlas Powder Co.
Darco Corp.
Luzerne Rubber Co. (hard rubber)

METAL CONTAINERS

Aluminum Co. of America
American Flange & Mfg. Co. (fittings for)
American Smelting & Refining Co.
S. Blickman, Inc. (stainless steel)
Dover Boiler & Plate Fabricators, Inc.
Graver Tank & Mfg. Co., Inc.
L. O. Koven & Bro., Inc.
Lebanon Steel Foundry
Pfaudler Co.
Pressed Steel Tank Co.

METALS

Allegheny-Ludlum Steel Corp. (tool, stainless, electrical carbon, plaramelt)
Aluminum Co. of America
American Smelting & Refining Co.
Baker & Co. (rare, fine wires, extruded wires, fine foils, ductile metals, lead, antimony, bismuth, tin)
Duriron Co., Inc.
Fansteel Metallurgical Corp. (tantalum, sheet, wire, tubing, fabricated equipment and parts)
Ingersoll Steel & Disc Div. Borg-Warner Corp. (corrosion resisting alloys, stainless steels, sheets, plates, armor plate)
International Nickel Co. (nickel, monel, Inconel, in all commercial forms)
Lukens Steel Co. (bi-metals, carbon and alloy steel, clad- nickel clad, monel clad, inconel clad, steel, plates)
United States Steel Corp.

METERS

American Meter Co. (displacement, gases, orifice and flow, remote control, orifice measurement, test, wet and dry, gas and air) Indexes-base pressure & volume LP gas)
Corning Glass Works (manometer, flowmeter, glass)
Fischer & Porter Co. (proportioning (Rotawier) flow, electrical recording, indicating, integrating, oil and tar, controlling flow of liquids, gas and vapors- density and viscosity compensating flow (Stabl-Vis Rotameters)
General Electric Co. (electric)
Hoke, Inc. (flow)
Illinois Testing Laboratories, Inc. (air velocity)
Meriam Co. (vertical or inclined tube for measuring flow of water, steam or gas up to 250 lb. pressure per sq. in.)

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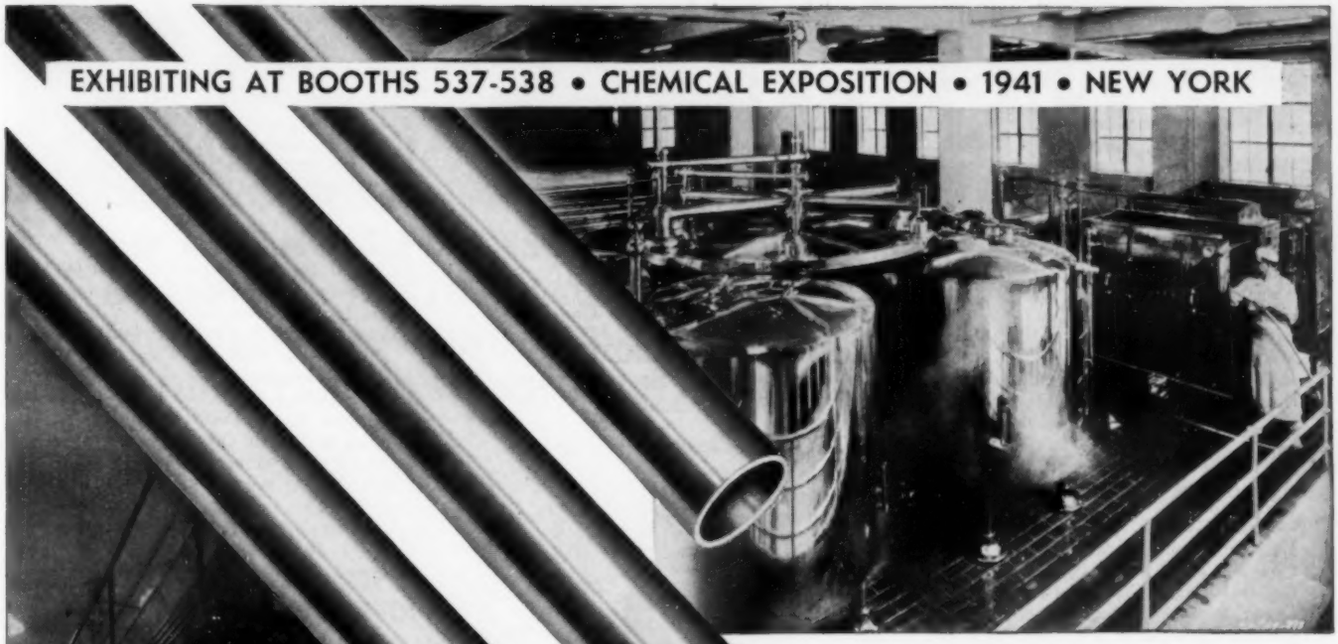

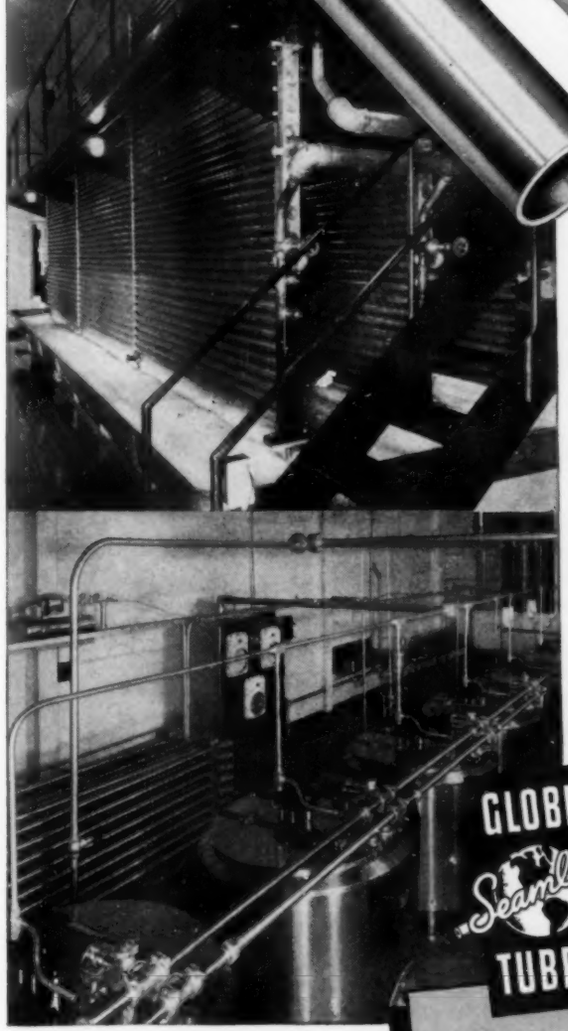

Positive

"STAINLESS" PROTECTION WHEREVER INSTALLED

To minimize corrosion — to avoid contamination of foods, chemicals, dyes, pharmaceuticals and other process products—stainless steel tubing is preferred by process industries and process equipment manufacturers . . . Cold drawing is desirable in the manufacture of stainless steel tubing—and Globe cold drawing is accomplished by an exclusive process, perfected by Globe many years ago, which eliminates the use of lead compound as a lubricant. Result—Globe Stainless Tubing is entirely free of lead or other metallic traces and wholly safe for food or other sanitary application. For complete information on the various alloys and types available in Globe Stainless Tubing, write:

GLOBE STAINLESS TUBE COMPANY
4006 W. BURNHAM STREET • MILWAUKEE, WISCONSIN

GLOBE STEEL TUBES
Stainless for Security
Seamless for Safety

STAINLESS TUBES
BOILER TUBES
CONDENSER AND HEAT EXCHANGER TUBES
MECHANICAL TUBING

National Technical Laboratories (pH)
Pittsburgh Equitable Meter Co. (water, gas, gasoline, orifice)
Schutte & Koerting Co. (flow)
Selas Co. (indicating, flow)
Westinghouse Electric & Mfg. Co. (electric)

MICROSCOPES

American Instrument Co.
Eimer and Amend
Mine Safety Appliances Co.
E. W. Pike & Co. (lenses, magnifiers)
Scientific Glass Apparatus Co.

MILLS

Abbe Engineering Co. (ball & Pebble)
Chemicolloid Laboratories, Inc. (colloid)
Denver Equip. Co. (ball, rod, tube)
Charles Engelhard, Inc. (colloid)
General Ceramics Co.
Great Western Mfg. Co. (roller)
Gump, B. F.
Hardinge Co., Inc. (ball, pebble, rod, tube and batch)
Jeffrey Mfg. Co. (hammer)
Kent Machine Works, Inc. (roller for paints, printing inks, cosmetics, etc.)
Lancaster Iron Works, Inc. (pug)
J. M. Lehmann Co., Inc. (for paint, lacquer and soap industry)
Paper & Industrial Appliances, Inc. (attrition)
Premier Mill Corp. (colloid)
Raymond Pulverizer Div. Combustion Engineering Co. (pulverizing)
Robinson Mfg. Co. (attrition, hammer, roller)
Sprout, Waldron & Co. (grinding)
United States Stoneware Co. (jar)
Williams Patent Crusher & Pulverizer Co. (roller, grinding)

MINERALS

Titanium Alloy Mfg. Co.

MIXING AND KNEADING MACHINERY

Abbe Engineering Co.
Alsop Engineering Corp.
Baker Perkins, Inc.
S. Blickman, Inc. (stainless steel blenders, agitated kettles, acid tanks)
Dover Boiler & Plate Fabricators, Inc.
Eastern Engineering Co. (industrial fluid type, vertical, side entering and portable mixers- turbine and propeller types- air powered, slow speed for viscous materials, high speed for blending)
Charles Engelhard, Inc. (mixing)
Gruendler Crusher & Pulv. Co.
Gump, B. F.
Hendrick Mfg. Co. (mixing)
Jay Bee Sales Co. (mixing)
Kent Machine Works, Inc. (paints and printing inks)
L. O. Koven & Bro., Inc.
Lancaster Iron Works, Inc.
Mixing Equipment Co., Inc.
National Engineering Co.
New England Tank & Tower Co.
Patterson-Kelley Co., Inc.
Pfaudler Co.
Premier Mill Corp.
Read Machinery Co., Inc.
Robinson Mfg. Co.
Sowers Mfg. Co.
Sprout, Waldron & Co.
Aurelio Tanzi Engineering Co. (for drugs and powders, laboratory and industrial use)
Turbo-Mixer Corp. (mixing)
W. S. Tyler Co.
United States Stoneware Co.

MOLDING MACHINERY

Lancaster Iron Works, Inc. (brick)
F. J. Stokes Machine Co.

MOTORS—Electric

Louis Allis Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

NAVAL STORES

Hercules Powder Co.
Marlo Co.

NITRATORS

Blaw-Knox Co.
Duriron Co., Inc.
General Ceramics Co.
Hendrick Mfg. Co.
Maurice A. Knight
Patterson-Kelley Co., Inc.
Pfaudler Co.
United States Stoneware Co.

NOZZLES—Spray

Link-Belt Co.
Luzerne Rubber Co. (hard rubber)
Monarch Mfg. Works, Inc.
National Carbon Co.
Paper & Industrial Appliances, Inc.
Schutte & Koerting Co.
United States Stoneware Co.

OILS AND GREASES

Garlock Packing Co.
Kinney Mfg. Co. (low vapor pressure oil for sealing high vacuum pumps)

OVENS—Electric—Laboratory

American Instrument Co.
Brabender Corp.
Carborundum Co.
Eimer & Amend
General Electric Co.
Scientific Glass Apparatus Co.
Westinghouse Electric & Mfg. Co.

OVENS—Industrial

Eclipse Fuel Engineering Co.
Selas Co.
Westinghouse Electric & Mfg. Co.

PACKING

Garlock Packing Co.
Electro Chemical Supply & Engrg. Co. (acid tower)
General Ceramics Co.
Gump, B. F.
Jeffrey Mfg. Co.
Johns-Manville
Marlo Co.
Owens-Corning Fiberglas Corp. (glass yarns for packing)
United States Stoneware Co.

PACKAGING EQUIPMENT

Bemis Bro. Bag Co.
Elgin Mfg. Co. (bottling, capping, filling machines)
Gumpf, B. F.
Horix Mfg. Co.
Karl Kiefer Machine Co. (automatic and semi-automatic for cleaning, filling, closing, conveying bottles, jars, tins, tubes)
Marsh Stencil Machine Co.
National Box & Lumber Co. (wooden)
New Jersey Machine Co.
PerfeKtum Products Co.
Pneumatic Scale Corp. (capping machines, bag packers, weighers, cartoning, wrapping)
Reeves Pulley Co.
St. Regis Paper Co.
Stokes & Smith Co.
Snytron Co. (electric hammers, vibrating packers)
Aurelio Tanzi Engrg. Co. (prescription wrapping machines with name or trade mark printed on)
Triangle Package Machinery Co.

PAILS

S. Blickman, Inc. (stainless steel)

PAINT—VARNISH—LACQUER

Dicalite Co. (flatting agents and extenders)
U. S. Stoneware Co.

PANELS—Instrument

Falstrom Co.

PANS

S. Blickman, Inc. (stainless steel for crystallizing, drying, evaporating, mixing, etc.)
Lee Metal Products Co., Inc. (vacuum, stainless steel, nickel and monel, standard line or built to specifications)

PAPER MACHINERY

S. Blickman, Inc. (stainless steel vats, trays, distribution boxes, head boxes, troughs)
Great Western Mfg. Co.
Paper & Industrial Appliances, Inc.
Productive Equipment Co.
Sprout, Waldron & Co.

PASTEURIZERS

S. Blickman, Inc. (stainless steel)

PERFORATED METALS

Great Western Mfg. Co.
Hendrick Mfg. Co.
Richmond Mfg. Co.

pH Control EQUIPMENT—(see Hydrogen Ion)

American Instrument Co.
Cambridge Instrument Co.
Coleman Electric Co., Inc.
National Technical Laboratories
PerfeKtum Products Co.
Scientific Glass Apparatus Co.
W. A. Taylor & Co.
Wallace & Tiernan Co., Inc. (testing kits)

PHARMACEUTICAL MACHINERY

Alsop Engineering Corp.
American Smelting & Refining Co.
S. Blickman, Inc. (stainless steel tanks, mixers, kettles, stills, dryers, evaporators, handling trucks)

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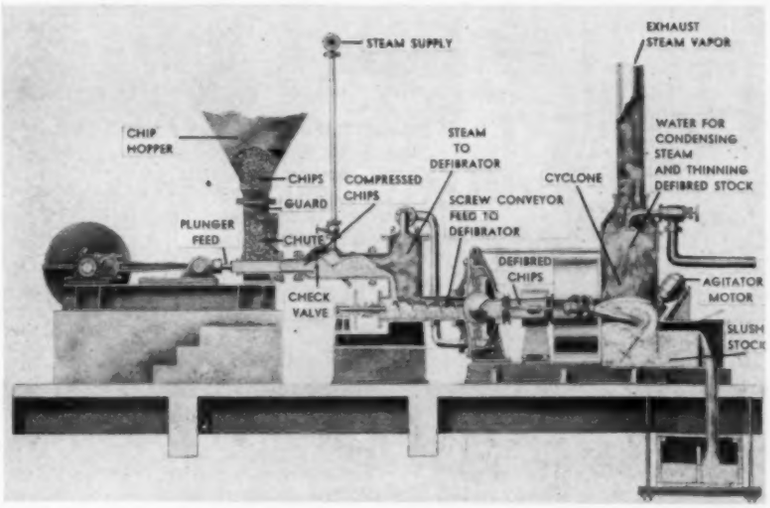
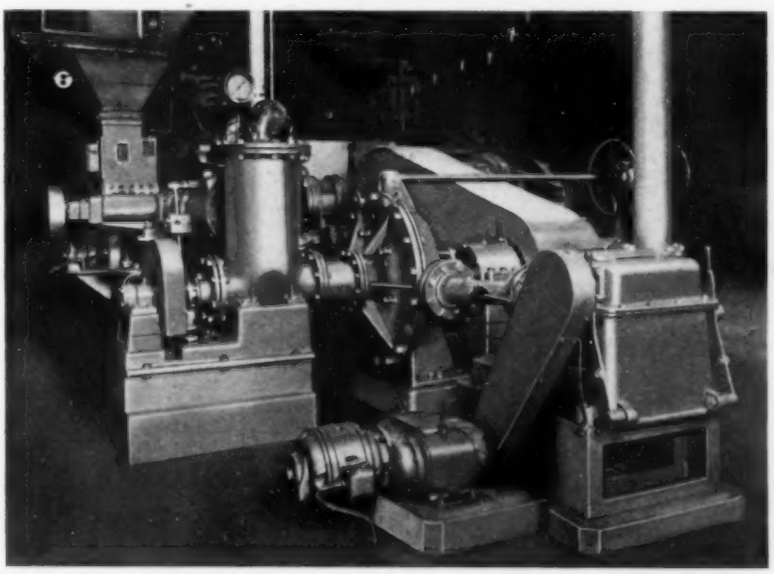
The Asplund DEFIBRATOR

AN ADVANCED PROCESS OF DEFIBERING LIGNO-CELLULOSE MATERIALS FOR THE MANUFACTURE OF WALL AND INSULATING BOARD, ROOFING AND FLOORING FELTS, MOLDED WOOD PRODUCTS, PLASTICS, AND FILLERS FOR NEW PRODUCTS



Flofoto of the DEFIBRATOR used for defibering wood chips, showing action from chips to slush stock. (U. S. Patent Numbers: 2,145,851—2,008,892—2,047,170. Canadian Patent Numbers: 337,404—335,302—355,303.) Patented in Foreign Countries.



Typical Defibrator Installation

Changing conditions are demanding many new methods of manufacture. Scarcity of materials necessitate use of substitutes in various fields. In the processing of ligno-cellulose materials, the Defibrator has radically changed existing methods of manufacturing certain types of pulps and fibres, heretofore produced mechanically. For example, in the roofing and flooring felt industry, the Asplund pulp is an excellent substitute for rags. Other uses are: as bulk insulating materials and low density board, with maximum yield about 96%. Practically all ligno-cellulose raw material of vegetable origin can be defibrated, such as different woods, straw, bagasse, bamboo, etc., and progress is being made in the use of the Defibrator for the manufacture of plastics, and fillers for many new products.

The remarkable results attained by users in many industries, (over 160 Defibrators in successful operation) have proved the outstanding advantages of this defibrating process, especially in the improvement of product quality and considerable reduction of production costs.

Perhaps you, too, have a particular problem that the Defibrator could solve for you. Your inquiry will incur no obligation.

New 20 page catalog, describing and illustrating the Defibrator, mailed upon request.

●

Visit our Exhibit at the Chemical Exposition, Grand Central Palace, New York City, December 1st to 6th.

AMERICAN DEFIBRATOR, INC., New York, N. Y.

Address Inquiries to R. D. KEHOE, *Sales Agent*

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New Jersey Machine Corp.
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Pfaudler Co.
Pneumatic Scale Corp.
Premier Mill Corp.
Pulverizing Machinery Co.
Read Machinery Co., Inc.
Richmond Mfg. Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
F. J. Stokes Machine Co.

PIGMENTS

American Resinous Products Corp.
Bay State Chemical Co.
Titanium Alloy Mfg. Co.

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Allegheny-Ludlum Steel Corp. (stainless)
Aluminum Co. of America (aluminum)
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Synthane Corp. (non-metallic)
Tri-Clover Machine Co. (stainless steel)
United States Steel Corp. (steel)
United States Stoneware Co. (acid)
Walworth Co. (CNI, Ni-Resist, Hi-Test, bending, coils, couplings, fabricated, fittings, flanges, hangers, headers, joints, tools, wrenches, unions, plugs, pipe wrenches, expansion joints, cocks, bushings)

PIPE—SILICA WARE

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American Hard Rubber Co.
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Casein Co. of America
Div. The Borden Co. (casein)
Garlock Packing Co.
General Electric Co.
Hercules Powder Co. (raw material)
Luzerne Rubber Co. (hard rubber)
Synthane Corp. (laminated)
United States Stoneware Co.

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Baker & Co., Inc. (electrodes, special apparatus, laboratory ware, Catalysts. Platinum and palladium on carriers, colloidal platinum and palladium, platinum, rhodium gauge cylinders and screens, silver screens)

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American Flange & Mfg. Co. (drum)

PNEUMATIC DESPATCH TUBES

Lamson Corp. (all sizes and for all purposes)

PORCELAIN WARE

Eimer & Amend
General Ceramics Co.
Lapp Insulator Co. (vacuum filters, kettles, pots)
Selas Co.
United States Stoneware Co.

POWER—Electric

Westinghouse Electric & Mfg. Co.

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Paramount Rubber Co.
Protective Coatings, Inc.

PRESSES—Hydraulic

American Instrument Co. (laboratory)
Fred S. Carver
F. J. Stokes Machine Co. (plastic molding)

PRESSURE VESSELS

S. Blickman, Inc. (stainless steel)

PROPORTIONING EQUIPMENT

Graver Tank & Mfg. Co., Inc.

PUBLICATIONS

Breskin Publishing Corp.
Chemical Industries
Chemical & Metallurgical Engineering
Food Industries
Industrial & Engineering Chemistry
McGraw-Hill Publishing Co.
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PULVERIZERS

American Instrument Co. (laboratory)
C. O. Bartlett & Snow Co.
Gruendler Crusher & Pulv. Co.
Hardinge Co., Inc.
Jeffrey Mfg. Co.
Kent Machine Works, Inc. (paint and printing ink)
Pulverizing Machinery Co.
Raymond Pulverizer Div. Combustion Engrg. Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
Williams Patent Crusher & Pulverizer Co.

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American Hard Rubber Co. (hard rubber and rubber lined)
American Instrument Co. (laboratory)
Beach-Russ Co. (vacuum and liquid)
Bump Pump Co. (positive, vacuum, pressure, acid, sanitary)
Corning Glass Works (glass)
Denver Equip. Co.
Dorr Co., Inc. (sludge)
Downingtown Mfg. Co.
Huber Pump Div. (chemical, laboratory)
Duriron Co., Inc. (acid resisting, Duriron, Durichlor, Durimet, 18-8-S, 18-8SMo, Centrifugal and plunger)
Eastern Engineering Co. (midget laboratory, transfer, circulating, positive pressure, sump, high pressure, collant)
Ertel Engineering Corp.
Farval Corp. (grease)
Fuller Co. (vacuum)
General Ceramics Co. (armored stoneware)
Hills-McCanna Co. (proportioning, centrifugal)
Henry E. Jacoby (diaphragm)
Karl Kiefer Machine Co.
Kinney Mfg. Co. (high vacuum, liquid)
Lebanon Steel Foundry
Luzerne Rubber Co. (hard rubber)
Monarch Mfg. Works, Inc. (oil)
Nash Engineering Co. (vacuum, centrifugal-standard and self priming-acid, gas, glass centrifugal, vacuum, steam heating, condensation with receiver, sump, sewage, corrosion resisting)
National Carbon Co. (Karbate)
New Jersey Machine Co. (vacuum and pressure, air)
Oliver United Filters, Inc. (acid handling, vacuum, diaphragm, slurry, centrifugal)
Milton Roy Pumps (acid, chemical, high pressure, proportioning, reciprocating, hydraulic)
Claude B. Schneible Co. (abrasive resistant)
Schutte & Koerting Co. (diaphragm)
T. Shriver & Co. (diaphragm)
F. J. Stokes Machine Co. (vacuum)
Tri-Clover Machine Co. (centrifugal, stainless steel)
United States Stoneware Co. (acid)
Wallace & Tiernan Co. (acid resistant, proportioning, reciprocating)
Waukesha Foundry Co. (positive, corrosion and acid resisting, "Waukesha" metal, pure metal, monel, stainless steel)

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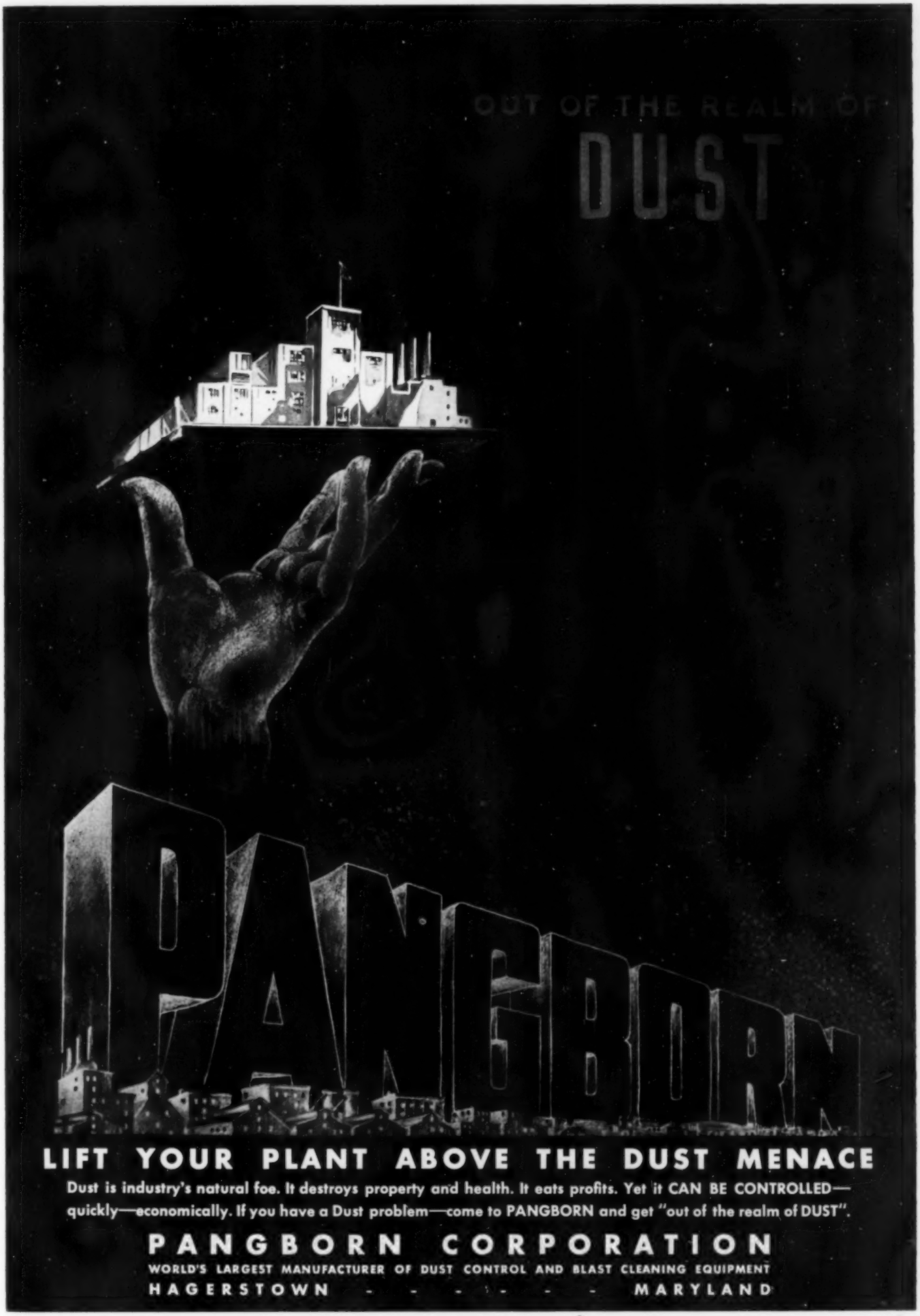

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Dust is industry's natural foe. It destroys property and health. It eats profits. Yet it CAN BE CONTROLLED—quickly—economically. If you have a Dust problem—come to PANGBORN and get "out of the realm of DUST".

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Cambridge Instrument Co.
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General Electric Co.
Hills-McCanna Co. (wells and tubes)
Illinois Testing Laboratories, Inc. (indicating type, portable and mounted)

PYROMETER PROTECTION TUBES

Carborundum Co.

QUARTZ

Hanovia Chemical & Mfg. Co. (fused)

RAW MATERIAL

Glyco Products Co., Inc.
Hercules Powder Co.
Titanium Alloy Mfg. Co.

RAYON EQUIPMENT

American Hard Rubber Co.
American Smelting & Refining Co.
Baker & Co., Inc. (spinnerettes, precious metals and base metals)
Baker Perkins, Inc.
Federal Classifier Systems, Inc.
Fischer & Porter Co. (flow meters)
Henry E. Jacoby
Lebanon Steel Foundry
Luzerne Rubber Co.
Pfaudler Co.
Robinson Mfg. Co.

RECORDING INSTRUMENTS

American Instrument Co.
Brabender Corp.
Cambridge Instrument Co. (Permeameters, moisture indicators, pyrometers, voltamographs)
Coleman Electric Co., Inc. (fluorimeters, spectrophometers)
Charles Engelhard, Inc.
Fischer & Porter Co. (flow)
Mine Safety Appliances Co.
Paper & Industrial Appliances, Inc.

RECTIFIERS

Fansteel Metallurgical Corp. (direct current power)

REFRACTORIES

Aluminum Co. of America
Carborundum Co. (cements, mufflers)
Electro Chemical Supply & Engrg. Co.
Johns-Manville
National Carbon Co. (carbon and graphite)
Norton Co.
Quigley Co., Inc.
Selas Co.
Titanium Alloy Mfg. Co.
United States Stoneware Co.

REFRIGERATING EQUIPMENT

Air & Refrigeration Corp.
Aluminum Co. of America
American Instrument Co.
General Electric Co.
W. A. Hammond Drierite Co.
King Refrigeration Co.
Luzerne Rubber Co.
Patterson-Kelley Co., Inc.
Westinghouse Electric & Mfg. Co.
York Ice Mchy. Corp.

REGULATORS—Pressure and Temperature

American Meter Co. (gas and air)
Eastern Engineering Co. (laboratory and industrial models, temperature)
Thomas A. Edison, Inc. Instrument Div. (relays, timing)
Charles Engelhard, Inc. (temperature)
Hoke, Inc. (pressure)
Matheson Co., Inc.
Pittsburgh Equitable Meter Co. (gas pressure)
Reeves Pulley Co.
Sarco Co., Inc.

RESPIRATORS

Martindale Electric Co.
Mine Safety Appliances Co.
Pangborn Corp.

RESINS AND OILS

American Resinous Products Corp.
Atlas Powder Co.
Bay State Chemical Co.
Casein Co. of America
Div. The Borden Co. (synthetic, emulsion)
Glyco Products Co., Inc.
Darco Corp.
Hercules Powder Co.
Neville Co.

ROLLS

S. Blickman, Inc. (stainless steel)

RUBBER PRODUCTS AND EQUIPMENT

Aluminum Co. of America
American Hard Rubber Co.
Ertel Engineering Corp.
Garlock Packing Co.
Luzerne Rubber Co. (tank linings, pipe and fittings, linings, toilet seats, sheets)
Paramount Rubber Co. (coatings, linings, insulation)
Pioneer Rubber Co. (neoprene gloves and aprons for industrial use)
Protective Coatings, Inc.
Robinson Mfg. Co. (rubber reclaiming equipment)
United States Stoneware Co.

RUST PROOFING

Paramount Rubber Co.
Protective Coatings, Inc.
Quigley Co., Inc.
United States Stoneware Co.

SAFETY EQUIPMENT

Black, Sivalls and Bryson, Inc.
Martindale Electric Co.
Mine Safety Appliances Co. (gas indicators for benzol, carbon monoxide, respirators, goggles, masks, clothing, hats, inhalators, first aid, face shields, ear defenders)
Newark Wire Cloth Co.
Pangborn Corp.
Pioneer Rubber Co. (neoprene gloves and aprons for industrial use)
Willson Products, Inc. (gas masks, goggles, helmets, welding)

SAND BLASTING EQUIPMENT

Pangborn Corp. (airless blast, cleaning, rotoblasting)

SCALES

Exact Weight Scale Co. (exact weight shadowgraphs, automatic selectors)
Fairbanks, Morse & Co.
Gump, B. F.
Kron Co.
Marsh Stencil Machine Co.
Stokes & Smith Co.
Syntron Co.
Toledo Scale Co.
Triangle Package Machinery Co.
Tripard Mfg. Co.

SCREENS—Inclined—Vibrating—Gyratory

Denver Equip. Co. (concentrating tables, pulsating jigs)
Great Western Mfg. Co.
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Link-Belt Co.
National Engineering Co.
Productive Equipment Co.
Read Machinery Co., Inc. (hopper)
Richmond Mfg. Co.
Robinson Mfg. Co.
Separations Engineering Co.
Syntron Co. (for hoppers, bins, chutes, concrete forms)
W. S. Tyler Co.
Williams Patent Crusher & Pulverizer Co. (mechanical air)

SCREENS—Other

Abbe Engineering Co.
C. O. Bartlett & Snow Co. (revolving)
Bird Machine Co. (paper)
Great Western Mfg. Co.
Gump, B. F.
Gruendler Crusher & Pulv. Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co. (revolving)
Link-Belt Co.
Newark Wire Cloth Co.
Productive Equipment Co.
Richmond Mfg. Co.
Robinson Mfg. Co.
Selas Co. (ceramic)
Sprout, Waldron & Co.
W. S. Tyler Co.

SEALING MACHINES

Gump, B. F.
Marsh Stencil Machine Co.
PerfeKtum Products Co. (ampoule)
Pneumatic Scale Corp.
Stokes & Smith Co.
Tripard Mfg. Co., Inc.

SEPARATORS

Baker Perkins, Inc. (centrifugals)
Black, Sivalls & Bryson, Inc. (oil and gas)
Federal Classifier Systems, Inc. (air)
S. G. Frantz Co., Inc. (magnetic)
Hardinge Co., Inc. (air)
Magnetic Engineering & Mfg. Co. (magnetic)
Raymond Pulverizer Div. Combustion Engrg. Co. (air)
Reineveld Corp. (centrifugal)
Richmond Mfg. Co.
Claude B. Schneible Co. (entrainment)
Separations Engineering Co.
Sharples Corp. (centrifugal)
Sprout, Waldron & Co. (screen)
Sutton, Steele & Steele, Inc. (electrostatic)

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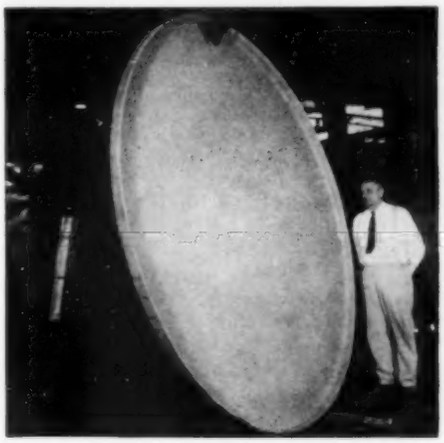


FLANGED ONLY HEAD: Flanged Head 9′ 0¾″ outside diameter by ⅜″ thick with a 2″ straight flange and 1⅛″ inside corner radius. This head was spun by Lukens from a flat circle of Nickel-Clad Steel 114⅞″ in diameter with unusually heavy clad layer of 30% nickel.

10 *Product-Protecting* VESSELS INSTEAD OF 1

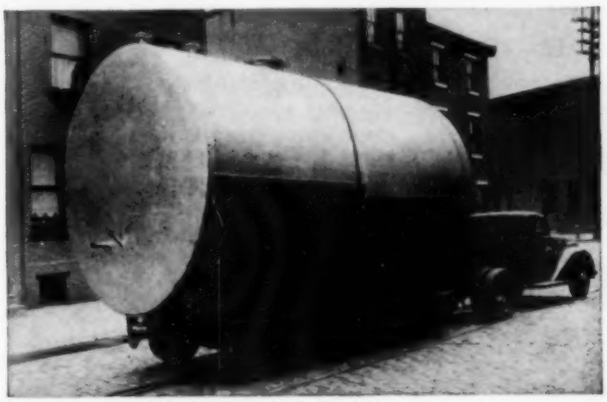
...Thanks To LUKENS Clad Steels

Today, the corrosion-resisting, product-protecting qualities of Lukens Clad Steels are doubly valuable to national defense and American industry. These economical bi-metals combine the corrosion-resisting qualities of nickel, Inconel or Monel with the economy of a steel base.

Every pound of nickel, Inconel or Monel makes possible ten times as much corrosion-resisting equipment fabricated of 10% Nickel-Clad, Inconel-Clad or Monel-Clad Steel.

Write for data on Lukens Clad Steels. Lukens Steel Company, 149 Lukens Building, Coatesville, Pa.

CAUSTIC SODA TANK: Practically all of the pure caustic soda made in this country is concentrated in nickel or Nickel-Clad evaporators. This storage tank, 8′ 0″ outside diameter and 8′ 0″ high, handling caustic soda at 50% concentration at 200° F. was fabricated of ¼″ thick 10% Lukens Nickel-Clad Steel by Combustion Engineering Company, Inc., Chattanooga, Tenn.



PHENOL STORAGE TANK: Particularly in the manufacture of plastics and explosives, the handling and storage of phenol presents the problem of iron contamination. Affording positive protection against harmful metallic contamination, Lukens Nickel-Clad Steel is widely used in phenol equipment. This 12,000 gallon phenol storage tank, 10′ 6″ in diameter and 18′ 6″ overall length was fabricated of 10% Lukens Nickel-Clad Steel by Liberty Coppersmithing Company, Philadelphia, Pa.

ACETONE STORAGE TANK: For the storage of acetone slightly acidulated with hydrochloric acid, this tank, 5′ 0″ in diameter and 21′ 0″ overall length, was fabricated from 5/16″ thick 20% Lukens Inconel-Clad Steel by Groen Manufacturing Company, Chicago, Illinois.

AT THE CHEMICAL SHOW
VISIT LUKENS'
BOOTHS NOS.
559, 560, 561, 562

You are cordially invited to visit the Lukens exhibit at the Chemical Industries Exposition. Interesting data on new applications of Lukens Clad Metals in the chemical field. Engineers in attendance will gladly discuss your problems.

LUKENS STEEL COMPANY • *World's Largest Plate Mill* • 149 LUKENS BUILDING • COATESVILLE, PA.

Lukens NICKEL-CLAD **CLAD** INCONEL-CLAD MONEL-CLAD *Steels*

SHEET METAL WORK
American Smelting & Refining Co.
S. Blickman, Inc. (stainless steel, gauges up to ¾" thick)
E. G. Budd Mfg. Co.
Buffalo Foundry & Machine Co.
Dover Boiler & Plate Fabricators, Inc.
Falstrom Co. (instrument panels, cubicles, cabinets, switch gear housings, welded steel products to order)
L. O. Koven & Bro., Inc.
Laboratory Furniture Co.
Sprout, Waldron & Co.

SIEVES—Laboratory
American Instrument Co.
Great Western Mfg. Co.
Newark Wire Cloth Co.
Richmond Mfg. Co.
W. S. Tyler Co.

SIFTERS
Abbe Engineering Co.
Great Western Mfg. Co.
Gump, B. F.
Newark Wire Cloth Co.
Productive Equipment Co.
Read Machinery Co.
Richmond Mfg. Co.
Robinson Mfg. Co.
Sprout, Waldron & Co.
W. S. Tyler Co.

SINKS—Laboratory—Acid Proof
Alberene Stone Corp. of Va.
American Smelting & Refining Co.
S. Blickman, Inc. (stainless steel, acid proof, rounded corners for easy cleaning)
Duriron Co., Inc.
General Ceramics Co.
Kewaunee Mfg. Co.
Maurice A. Knight
Laboratory Furniture Co.
Luzerne Rubber Co.
Leonard Peterson & Co., Inc.
E. H. Sheldon & Co.
United States Stoneware Co.

SOLVENT RECOVERY EQUIPMENT
Aluminum Co. of America
American Smelting & Refining Co.
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
E. G. Budd Mfg. Co.
Buffalo Foundry & Machine Co.
Ertel Engineering Corp.
Fischer & Porter Co. (flow meters, rotameters)
General Ceramics Co.
Henry E. Jacoby
Koppers Co.
National Carbon Co. (carbon, graphite, Karbate)
Patterson-Kelley Co., Inc.
Pfaudler Co.
F. J. Stokes Machine Co.
United States Stoneware Co.

SOLVENTS
Atlas Powder Co.
Commercial Solvents Corp.
Darco Corp.
Koppers Co.
Neville Co.

SPRAY DRYING SYSTEMS
Monarch Mfg. Works, Inc. (nozzles for)

SPEED REDUCERS
Cleveland Worm & Gear Co.
Link-Belt Co. (herring bone, worm, motorized)
New England Tank & Tower Co.
Philadelphia Gear Works
Reeves Pulley Co.

STAIR STEPS—Safety
Blaw-Knox Co.

STEEL GRATING AND FLOORING
Blaw-Knox Co.
Hendrick Mfg. Co.
United States Steel Corp.

STEELS
Allegheny-Ludlum Steel Corp. (tool, stainless, electrical carbon, plara-melt)
Ingersoll Steel & Disc Div. Borg-Warner Corp. (stainless, plates, sheets, armor)
Lukens Steel Co. (bi-metals, heads, plates)
Republic Steel Corp. (stainless, all commercial forms)
United States Steel Corp.

STERILIZERS
Buffalo Foundry & Machine Co.
Eimer & Amend
Ertel Engineering Corp.
Hanovia Chemical & Mfg. Co.
Scientific Glass Apparatus Co.
Wallace & Tiernan Co. (water, chlorinators)

STILLS
Aluminum Co. of America (water and chemical)
American Instrument Co. (laboratory)
American Smelting & Refining Co. (lead)
Barnstead Still & Sterlizer Co., Inc. (water)
Blaw-Knox Co.
S. Blickman, Inc. (stainless steel)
Buffalo Foundry & Machine Co. (solvent recovery, fractionation, fatty acid)
Dover Boiler & Plate Fabricators, Inc. (all)
Eclipse Fuel Engineering Co. (water)
Eimer & Amend (water)
Electro Chemical Supply & Engrg. Co. (acid)
General Ceramics Co. (chemical stoneware)
Graver Tank & Mfg. Co., Inc.
Henry E. Jacoby (solvent recovery)
L. O. Koven & Bro., Inc.
Lancaster Iron Works, Inc.
Patterson-Kelley Co., Inc. (general)
Pfaudler Co. (glass lined)
Sowers Mfg. Co. (batch)
F. J. Stokes Machine Co. (water solvent)
United States Stoneware Co. (acid)

STRAINERS
Alsop Engineering Corp.
Kinney Mfg. Co. (plain and steam jacketed)
Luzerne Rubber Co.
Monarch Mfg. Works, Inc.
Newark Wire Cloth Co.
Sarco Co., Inc. (pipe line)

STRAPPING—Steel
Acme Steel Co. (box, machines for)
Allegheny-Ludlum Steel Corp.
Tripard Mfg. Co., Inc.

SUGAR MAKING MACHINERY
Goslin-Birmingham Mfg. Co., Inc. (cane milling plants, evaporators and vacuum pans)

SWITCHES
Westinghouse Electric & Mfg. Co. (electric)

TACHOMETERS
General Electric Co.
Reeves Pulley Co.
Westinghouse Electric & Mfg. Co. (electric)

TANKS
Alsop Engineering Corp. (glass lined)
Aluminum Co. of America
American Hard Rubber Co. (rubber lined)
Black, Sivalls and Bryson, Inc. (steel and wood)
S. Blickman, Inc. (stainless steel, all sizes and shapes, round corner, mixing, beverage, transportation, blending, storage, fruit juice, cooking, syrup, truck)
E. G. Budd Mfg. Co. (storage)
Dover Boiler & Plate Fabricators, Inc. (all)
Electro Chemical Supply & Engrg. Co. (acid)
General Ceramics Co. (chemical stoneware)
Haynes Stellite Co. (corrosion resisting)
Graver Tank & Mfg. Co., Inc.
Hendrick Mfg. Co. (mixing)
Henry E. Jacoby (non-ferrous)
Maurice A. Knight
L. O. Koven & Bro. (all)
Lancaster Iron Works, Inc.
Lee Metal Products Co., Inc. (stainless steel, nickel and monel, plain or jacketed, flat or dished bottom, agitators if desired)
Luzerne Rubber Co. (hard rubber)
National Carbon Co. (carbon, graphite, Karbate, and linings)
New England Tank & Tower Co. (wood)
Paramount Rubber Co. (rubber lined)
Patterson-Kelley Co., Inc. (any type, any metal, lined or plain, code or non-code, except those erected out of doors)
Pfaudler Co. (glass lined, nickel, stainless)
Pressed Steel Tank Co. (air)
Protective Coatings, Inc. (rubber lined)
F. J. Stokes Machine Co. (impregnating)
United States Stoneware Co. (acid)

TESTING EQUIPMENT
American Instrument Co. (materials)
Wallace & Tiernan Co. (chlorine)

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